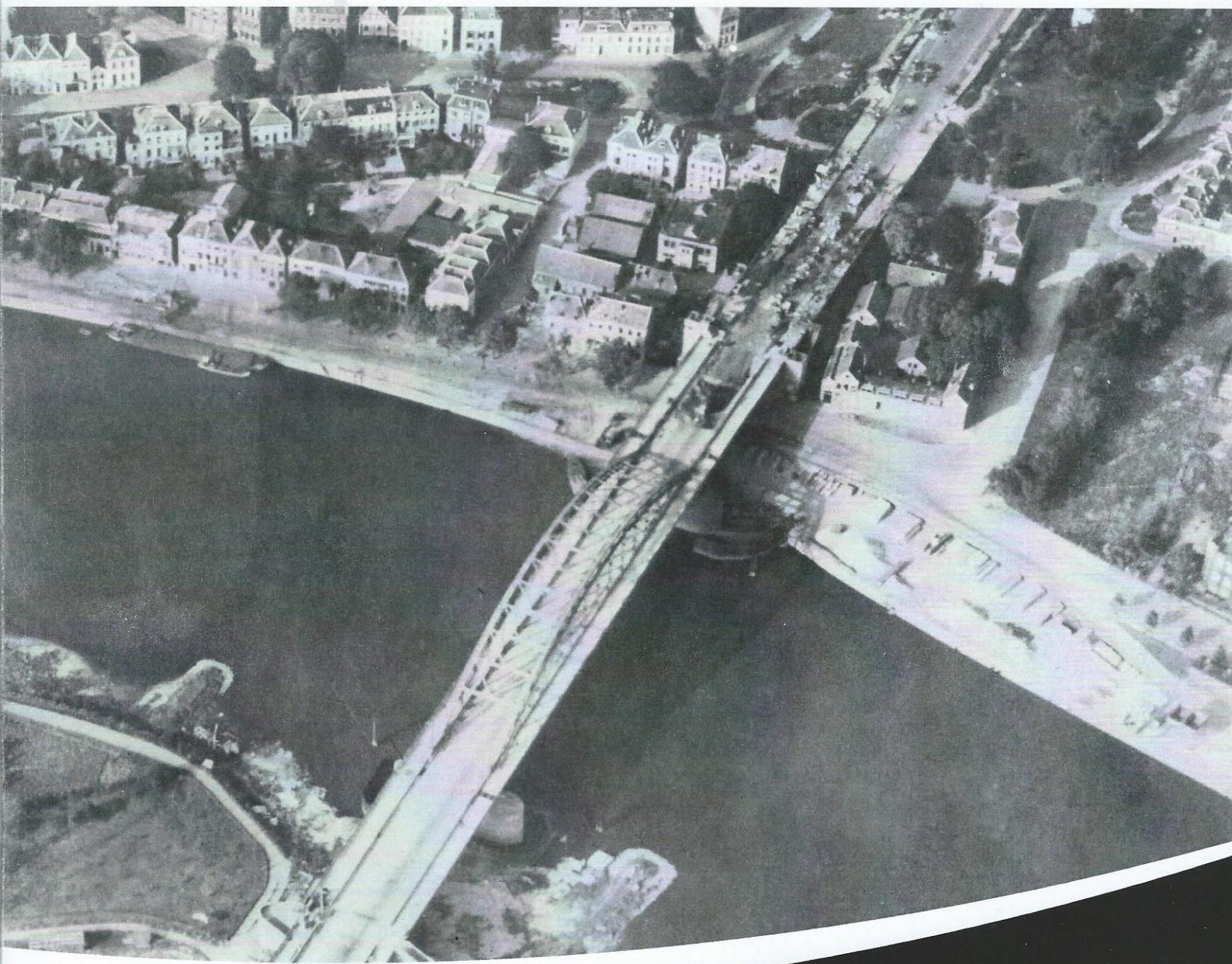


Arnhem

The Air Reconnaissance Story

Air Historical Branch (Royal Air Force)



Author

Sebastian Ritchie

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Second Edition

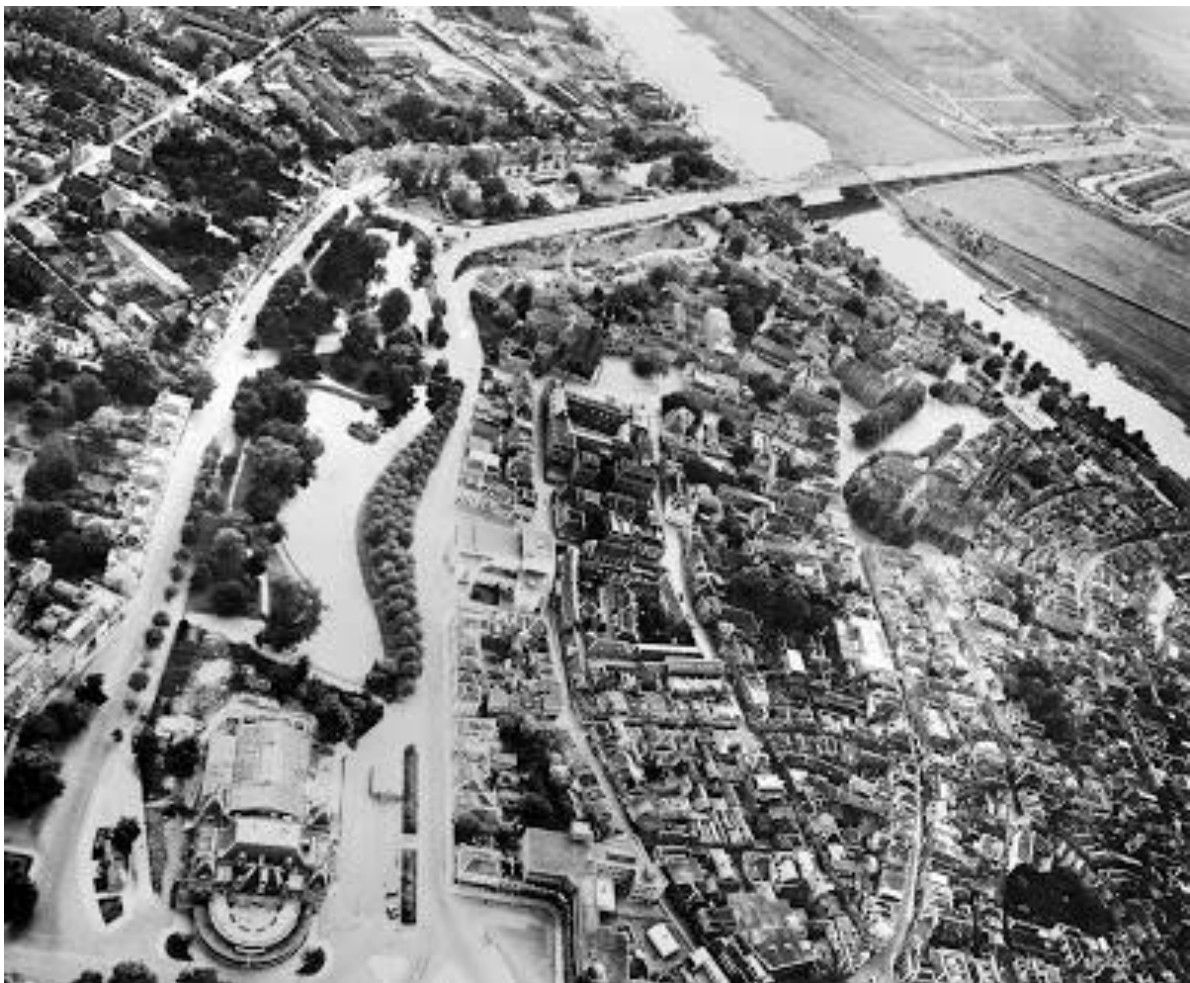
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The relationship between intelligence and the failure of Operation Market Garden in September 1944 has long fascinated the military history community. The operation appears to offer the clearest possible example of intelligence failure, highly effective intelligence collection apparently being squandered as a result of flawed processing, exploitation and dissemination. In the words of Stephen Ambrose, 'The British were outstanding in gathering intelligence, lousy in using it.'⁽¹⁾ Furthermore, while all of the various intelligence disciplines were drawn on by the Allies in the days leading up to the operation, the story of one particular air reconnaissance mission has come to symbolise, beyond all else, the perception that they failed disastrously to exploit such information as was available to guide operational planning. It is said that the Allies actually succeeded in obtaining air photographs of German armoured units near to Arnhem – their key operational objective – only days before Market Garden was launched, yet this apparently vital intelligence exerted no influence upon their plans whatsoever. In turn, this failure is sometimes employed to suggest a broader tension between the intelligence and operations spheres and upheld as an extreme manifestation of a problem that is as old as military history itself.⁽²⁾

The prominence assigned by historians to this single episode is not difficult to understand. Although air reconnaissance provides but one of several main sources of intelligence, it is often considered to be more directly useful and persuasive than the others. Intercepted communications, or SIGINT, vital as it was in the Second World War, was subject to delays pending decryption and rigid circulation restrictions; its very secrecy sometimes inhibited full exploitation, and SIGINT leads were often so fragmentary that their true significance was overlooked. Intelligence from agents on the ground (HUMINT) depended then, as now, upon their absolute reliability, which was by no means always certain. The interpretation of intelligence derived from both sources was necessarily somewhat subjective, and dependent on the training, experience and perspective of analysts and intelligence staff, and on such supporting information as was available to them. By contrast, air imagery has always appeared far more tangible, offering a visual and objective confirmation of enemy activity, which is established beyond doubt at a given place and time. Hence the implication in many studies of Market Garden that, while there might have been a case for questioning

SIGINT or HUMINT, there could be no excuse for ignoring air photographs of German tanks at Arnhem.

But is this really a fair judgement on the events of September 1944? What did air reconnaissance actually tell the Allies before Market Garden was launched, and is history correct to focus so much on the famed ‘tanks at Arnhem’ episode to the virtual exclusion of other air reconnaissance issues? In this study, the aim is to address the background to the Arnhem operation and the broad thrust of the intelligence narrative, before turning the focus more specifically to air reconnaissance and assessing the potential significance of the available imagery, including recently discovered photographs of German armour. Context is all-important in considering the information available and the apparent failure to use it to full advantage.



The Arnhem road bridge; key objective of Operation Market Garden

The basic concept of achieving a Rhine crossing at Arnhem was formulated by Field Marshal Bernard Montgomery's 21st Army Group in the first week of September 1944. The origins of the plan may be identified in Montgomery's 'single thrust' strategy, which he famously promoted in preference to the 'broad front' favoured by Eisenhower, following the Allied breakout from Normandy in August. In Montgomery's view, if underpinned by absolute logistical prioritisation, this aggressive and ambitious manoeuvre offered the most likely means to defeat Hitler's Germany before the end of 1944. But Market Garden also owed much to rivalry between the British and American army groups. Montgomery was determined to beat the Americans into Germany, and the northerly orientation selected for the operation ensured absolute separation from the American advance through northeast France. His original plan, codenamed Comet, envisaged the use of a single airborne division, the British 1st Airborne, to seize bridges across the Maas, Waal and Neder Rhine, to allow Lieutenant General Sir Miles Dempsey's Second Army to advance from Holland into Germany and envelop the Ruhr industrial region. Approved on 4 September, Comet was twice postponed and then, on the 10th, superseded by Market, the airborne element of Market Garden, which involved three divisions – 1st Airborne and the US 82nd and 101st Airborne.(3)

Launched just one week later, on 17 September, Market Garden ended in failure primarily because of far stronger enemy opposition than expected – notably at Arnhem itself, where 1st Airborne Division was effectively destroyed. For many years, the popular belief was that the Allied defeat resulted from the fact that 1st Airborne landed directly on top of two crack German armoured divisions, 9th and 10th SS Panzer Division – II SS Panzer Corps, commanded by General Wilhelm Bittrich. The lightly equipped British paratroops were thought to have been overwhelmed by hordes of first-class SS soldiers equipped with hundreds of modern tanks. This general perception endured right through to the 1980s, having been reinforced by the film, *A Bridge Too Far*. Gradually, however, it became clear that the composition of the German forces at Arnhem was far more complex than most published histories of Market Garden had tended to suggest. The two SS panzer divisions had been operating far below their full strength on the eve of the operation. Furthermore, while 1st Airborne were ultimately confronted by armour in considerable strength, hardly any

tanks had actually been present in the Arnhem area on 17 September. The vast majority deployed from Germany or other battle fronts after the airborne landings.(4)

During the battle itself, II SS Panzer Corps were augmented by Wehrmacht troops and a multiplicity of other elements, including many undertrained, inexperienced, low-grade and poorly equipped personnel drawn from almost every quarter of the German armed forces. They included miscellaneous units retreating from France, Belgium and Southern Holland, Dutch SS, Luftwaffe and naval personnel, convalescents, home defence and garrison troops. According to a later study,

On the basis of information received about the enemy, the Germans anticipated airborne operations. Furthermore, the commanders in the nearby home defence zone (Wehrkreis VI and Luftgau VI) as well as in Holland had made arrangements well in advance, in order to be able in such cases to quickly organise motorised auxiliary forces (so-called 'alert units') with home defence troops and occupation forces, which would be available immediately.(5)

These preparations allowed the Germans to create ad hoc or 'scratch' formations, such as Kampfgruppe Von Tettau and 406 Division, and mobilise them against 1st Airborne and 82nd Airborne (respectively) within 24 hours of the initial landings. Not surprisingly, many of the units involved suffered heavy casualties, but they made a critically important contribution to the German victory.(6) Nevertheless, the popular view of II SS Panzer Corps' role remains influential to this day.

What did Allied intelligence discover about German forces in the Market Garden area? The preponderance of intelligence collection and assessment activity relating first to Comet and then Market was directed by 21st Army Group and Second Army, headquartered in Belgium by early September 1944. Back in the UK, Headquarters First Allied Airborne Army was heavily dependent on these deployed formations for intelligence support. Airborne Headquarters did receive so-called ULTRA – high-grade signals intelligence from decrypted German messages sent via the Enigma cypher machine, but the broader intelligence required to set the ULTRA in context was often lacking.(7) At 21st Army Group, the head of intelligence was Brigadier Edgar 'Bill'

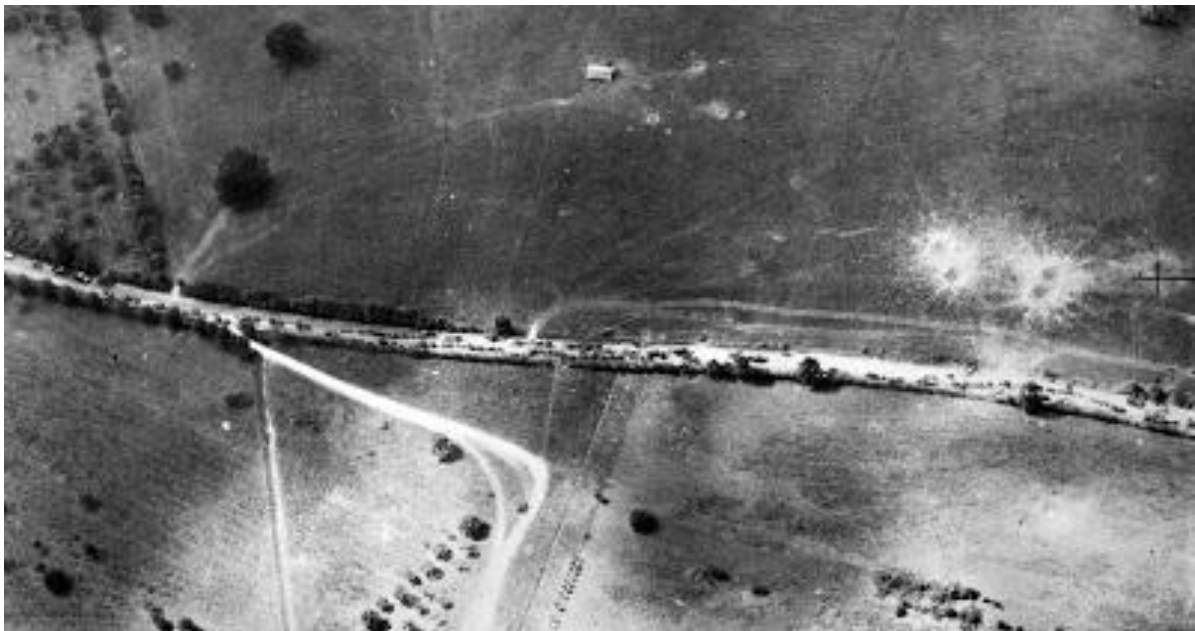
Williams. Williams was not an intelligence professional or even a professional soldier. He was, in fact, an Oxford don, who had joined the Army in 1939. He did not hold an intelligence post until 1942 and his rank of brigadier was entirely nominal. He was, no doubt, a highly intelligent and capable analyst but we may legitimately question whether he was the right man to command a large and complex intelligence organisation.(8)

The possibility of an advance through the Low Countries into Germany was first seriously considered by 21st Army Group at the end of August 1944. In topographical terms, this route was never promising. It was clear that there were too many river crossings and that an advance would be restricted to a small number of roads that could easily be blocked. But all the available intelligence on enemy dispositions appeared more optimistic. The Germans were in headlong retreat after being routed in Normandy, where they had incurred vast losses of manpower and equipment. In the Low Countries, their defences were particularly weak; moreover, the German fixed defence line, the Siegfried Line, could be bypassed by a left hook through Holland.(9) It was this basic assessment that underpinned the decision to launch Operation Comet.

Unfortunately, immediately after Comet was approved, ULTRA revealed that II SS Panzer Corps had been ordered to the Arnhem-Nijmegen area. After narrowly escaping from the Falaise Pocket, they had withdrawn across France only slightly ahead Allied ground forces, straddling routes along which Dempsey's Second Army and the US First Army were advancing. They were regularly mentioned in intelligence summaries at the end of August and in early September. On 30 August, 101st Airborne Division – then preparing for an operation in the Tournai area – were warned of the presence of 10th SS Panzer Division in northern France.(10) The next day, Second Army captured German maps revealing 'as part of the enemy's intentions, a concentration area for 9th and 10th SS Panzer Divisions just east of Amiens.' In the event, the Allied advance was so rapid that this plan could not be implemented.(11)



Destroyed German tanks in the Falaise Pocket



German forces fleeing the Falaise Pocket, August 1944

On 2 September, Second Army identified 10th SS Panzer Division around the town of Albert, and their intelligence summary also mentioned a report that around 40 tanks belonging to 9th SS Panzer Division had left Amiens on 30 August and were moving to St Quentin.(12) On the same day, elements of 9th SS Panzer Division were in action against First Army forces around Cambrai.(13) On the 3rd, their whereabouts were said to be 'somewhat of a mystery' but Second Army speculated that they were probably moving back towards Germany on their right flank. Even then, there was said to be evidence that the two divisions were east of Arras.(14) On 4 September, the day Montgomery selected Arnhem as the objective for Operation Comet, they did not

feature in Second Army's intelligence summary, probably because they were located around Maastricht by this time, well inside First Army's area of responsibility.(15)

It was on the 5th that Enigma decrypt XL9188 relayed the following order to the Allies: '9 SS and 10 SS Panzer Division elements not operating to be transferred for rest and refit in area Venlo-Arnhem-'s Hertogenbosch.'(16) A further signal, decrypted on the 6th, located II SS Panzer Corps' headquarters and 9th SS Panzer Division in the more northerly part of this area – Arnhem.(17) This unwelcome news placed 21st Army Group intelligence in a difficult position, given Montgomery's steadfast determination to maintain the forward impetus of his advance. Their initial response to the ULTRA has not survived among the official files, but it was evidently sceptical, judging by the recorded reaction of their subordinate formations and their responses to later intelligence on II SS Panzer Corps. That the order had been issued was beyond doubt, but this did not necessarily mean that it had been implemented, such was the chaotic nature of the German retreat across Northern France. Moreover, it was known that 9th and 10th SS Panzer Division were operating at a fraction of their former strength after the fighting in Normandy and along the main lines of retreat. So the ULTRA warning was not treated as a showstopper. Sanitised intelligence was passed down to corps and divisional levels, including 1st Airborne Division, referring to reports from POWs and other sources that II SS Panzer Corps had been sent to Arnhem to refit.(18)

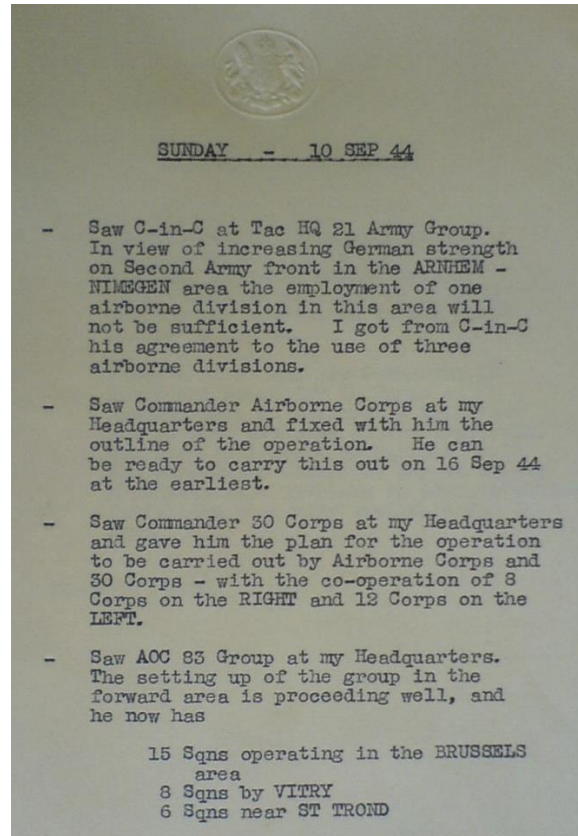
The relaxed outlook of 21st Army Group headquarters was not unanimously shared. Indeed, the ULTRA caused particular concern to Second Army's commanding officer, Dempsey. Other intelligence was also suggesting – correctly as events turned out – a larger military presence around the key objectives than originally thought, and the movement of lower-grade German troops, such as trainees, to and through Arnhem and Nijmegen. As one intelligence summary put it, 'Fresh units keep appearing on the scene, none of them of divisional size but all of them adding weight to the infantry defences in the area.'(19) In short, it now appeared that the planned offensive might well encounter strong opposition.

The flavour of reporting in this period is accurately captured at airborne divisional level, where it was deduced as early as 6 September that the Germans were likely to have assigned a high priority to the defence of the Maas, Waal and Neder Rhine bridges,

and that the numerical equivalent of one division might be encountered in the Arnhem-Nijmegen area.(20) This conclusion was based overwhelmingly on intelligence supplied from the continent. On the 7th, it was reported in a divisional planning intelligence summary that 'one of the broken Panzer divisions has been sent back to the area north of Arnhem to rest and refit' – a direct reference to II SS Panzer Corps. They were thought to possess around 50 tanks. 'There seems little doubt that our operational area will contain a fair quota of Germans, and the previous estimate of one division may prove to be not far from the mark.' SS training units previously located in Amsterdam had been moved to Nijmegen, and it was suspected that fixed defences were being strengthened in the high ground south-east of the city.(21)

Next day, there was little change in this assessment and the intelligence summary now noted not only a potential threat from both 9th and 10th SS Panzer Division but also the escape of many German troops from the coast into Northern Holland.(22) A Dutch resistance group known as 'Albrecht' meanwhile reported that SS and Wehrmacht troops had moved into barracks and school buildings in and around Arnhem.(23)

On the basis of such information, Dempsey became convinced that the operation plan should be changed. The enemy 'appreciates the importance of the area Arnhem-Nijmegen', he wrote in his diary. 'It looks as though he is going to do all he can to hold it.' He initially proposed that the Rhine crossing be switched from Arnhem to Wesel, further to the south, but Montgomery was determined to retain Arnhem as the objective and received vital support from the British Chiefs of Staff, who saw in his plan a means to cut off V-2 launch areas in Western Holland from their main sources of supply in Germany. So, instead, Montgomery and Dempsey agreed to enlarge the airborne force from one to three divisions, and Comet made way for Market.(24)



The genesis of Market Garden was recorded by Dempsey in his diary

Dutch reports noting the arrival of elements of 9th SS Panzer Division at Arnhem reached the Allies between 11 and 13 September. A personnel-collection point had been established, and 'panzer troops' had moved into the Saksen-Weimar Barracks.(25) A further document suggested that both the 9th and 10th SS Panzer Divisions had been withdrawn to the Arnhem area. The original report has not survived, so we do not know its precise contents, but elaborating information suggested that the two divisions were probably being refitted from a depot at Cleve, east of the Reichswald Forest, in the Nijmegen sector.(26) The commander of 1st Airborne Division also confirmed that 'Dutch resistance reports had been noted to the effect that "battered panzer remnants have been sent to Holland to refit".'(27) The accuracy of this information was viewed by 21st Army Group intelligence as possible but by no means certain, and they continued to insist that, heavily written down, II SS Panzer Corps would not pose a significant threat.(28)

From then on, Second Army closed ranks with 21st Army Group, where intelligence was concerned. When Lieutenant Colonel Anthony Tasker, head of intelligence at First

Allied Airborne Army headquarters, journeyed to Belgium on 12 September, he found far greater optimism and a pronounced tendency to play down reports of enemy activity around Arnhem. Notably, it was contended that many of the units formerly suspected of being in the area had moved up to the front line. The only German reinforcements to have appeared in the Low Countries 'had been put in to thicken up the line' they were attempting to form on the Albert Canal. Tasker found 'no direct evidence that the area Arnhem-Nijmegen is manned by much more than the considerable flak defences already known to exist.'⁽²⁹⁾ The airborne divisions were briefed accordingly. Another very cautious intelligence summary had been circulated within 1st Airborne on 13 September, warning of the potential presence of German troops in and around Arnhem and of some 10,000 troops to the north, which 'may represent a battle-scarred Pz Div or two reforming.'⁽³⁰⁾ However, on the basis of the information supplied to Tasker, there seemed to be little cause for concern. The next day's summary duly concluded that 'a more optimistic estimate can be made of enemy forces actually in the Divisional area.'

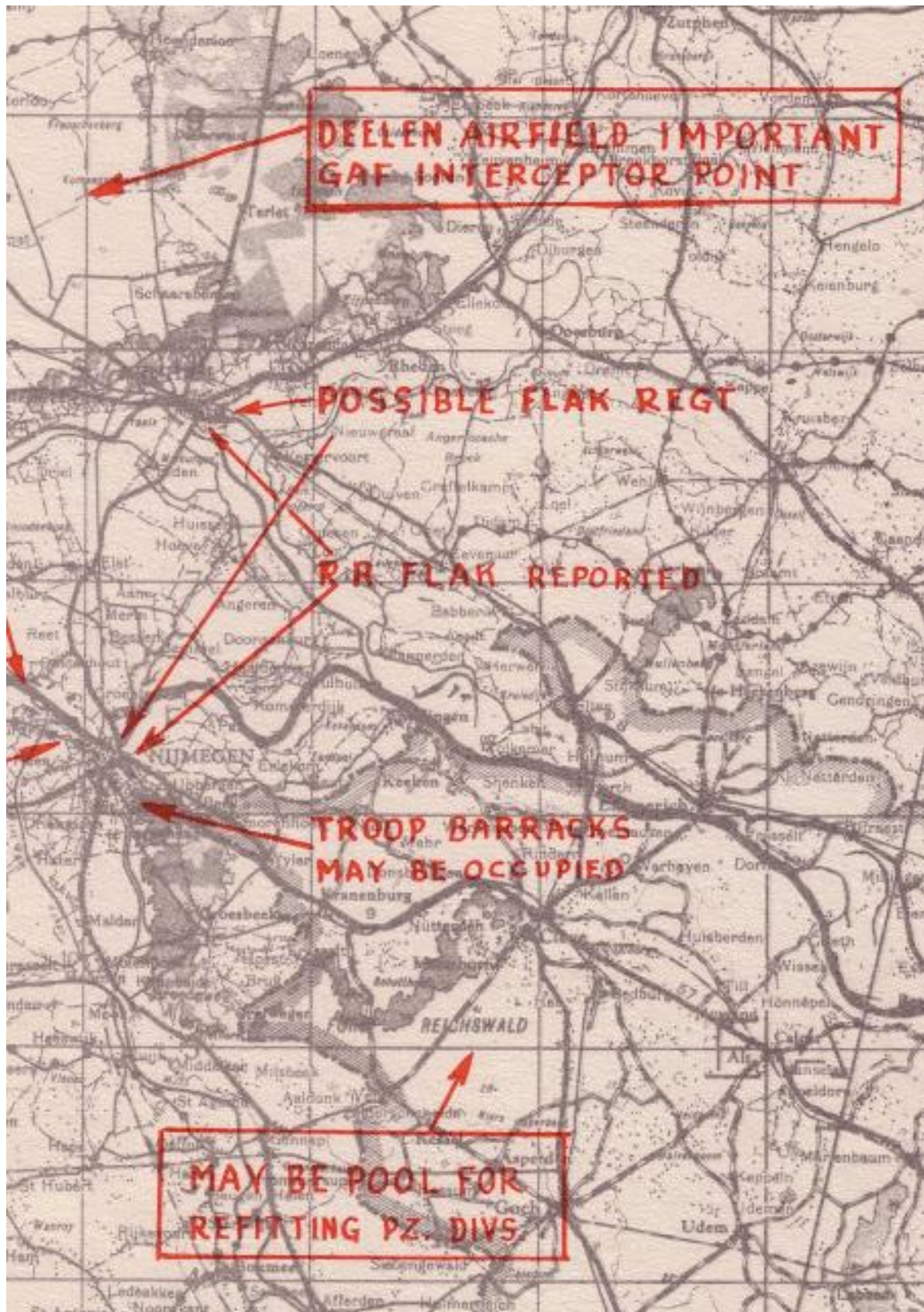
The main factor, on which all sources agree, is that every able-bodied man in uniform who can be armed is in the battle – the Germans are desperately short of men and it is improbable that any formations capable of fighting will be found in an L[ine] of C[ommunication] area, however important it may be. The barracks and billeting areas in Ede and Arnhem are not likely, then, to contain fighting troops unless they are in transit from NW to SE or regrouping in the area, and there are precious few troops left in Northern Holland now to move. Identifications in the Albert Canal area satisfactorily prove that practically all the enemy troops which could have been in Northern Holland are now actually engaged.⁽³¹⁾

Ironically, then, the accuracy of multi-source intelligence assessments actually declined somewhat in the days immediately before Market Garden was launched, leaving the airborne with a very misleading picture of the reception awaiting them.

Meanwhile, on the 14th, a further Dutch Resistance report sent to the British intelligence service, MI6, firmly identified 9th SS Panzer Division at specific locations

just northeast of Arnhem.(32) The Dutch intelligence was by this time causing alarm at the Allied Supreme Headquarters, where Major General Kenneth Strong was head of intelligence. Strong, unlike Williams, was a career intelligence officer, who had worked his way up through one G2 post after another in the British Army. When he reported that 9th and 10th SS Panzer Division had been sent to Holland to refit, the potential threat was taken so seriously that Eisenhower's chief of staff, Lieutenant General Walter Bedell Smith, personally visited Montgomery and proposed further changes to Operation Market. Specifically, he recommended the deployment of a second airborne division at Arnhem, if necessary, at the expense of the American landings further south. But Montgomery, having already strengthened the airborne plan, refused to accept that any further measures were necessary. Bedell Smith later recalled that he 'ridiculed the idea' and 'waved my objections airily aside'.(33)

A recent biography of Bedell Smith calls this account into question. While the key SHAEF intelligence document is dated 16 September, Bedell Smith's only recorded visit to Montgomery's headquarters occurred on the 11th. He could not, therefore, have visited Montgomery in person to discuss the intelligence report.(34) This contention reflects a widespread misconception about the SHAEF report. It was, in fact, a weekly summary covering the period up to, and including, the 16th. Hence, it is entirely possible, indeed likely, that Bedell Smith discussed the intelligence with Montgomery when the two officers met five days earlier.



A Market Garden intelligence map; note reference to 'REFITTING PZ. DIVS'

As for Williams, he clung to his conviction that the two German divisions were too weak to jeopardise Market Garden's ultimate success. Even after the first contact between Allied troops and II SS Panzer Corps during Market Garden, he stood by his original assessment, insisting that 9th SS Panzer Division 'cannot be in a very formidable state'.⁽³⁵⁾ Williams was correct to the extent that 9th and 10th SS Panzer Division were heavily depleted and had few tanks; but he and Montgomery substantially underestimated their residual combat capability.⁽³⁶⁾ As Montgomery noted in his memoirs, 'The 2nd SS Panzer Corps was refitting in the Arnhem area ... We knew it was there. But we were wrong in supposing that it could not fight effectively; its battle state was far beyond our expectation.'⁽³⁷⁾ Bittrich's troops were, for the most part, well led, well trained and very experienced. Moreover, although they had lost nearly all their tanks, they still possessed armoured cars and half-tracks, other motorised transport and some heavy weapons, together with ample resources of excellent small arms and plenty of ammunition; and they were sustained by over-land supply lines, which their airborne adversaries inevitably lacked. Furthermore, before the Allied landings in Normandy, II SS Panzer Corps had been intensively schooled in counter-airborne warfare.⁽³⁸⁾

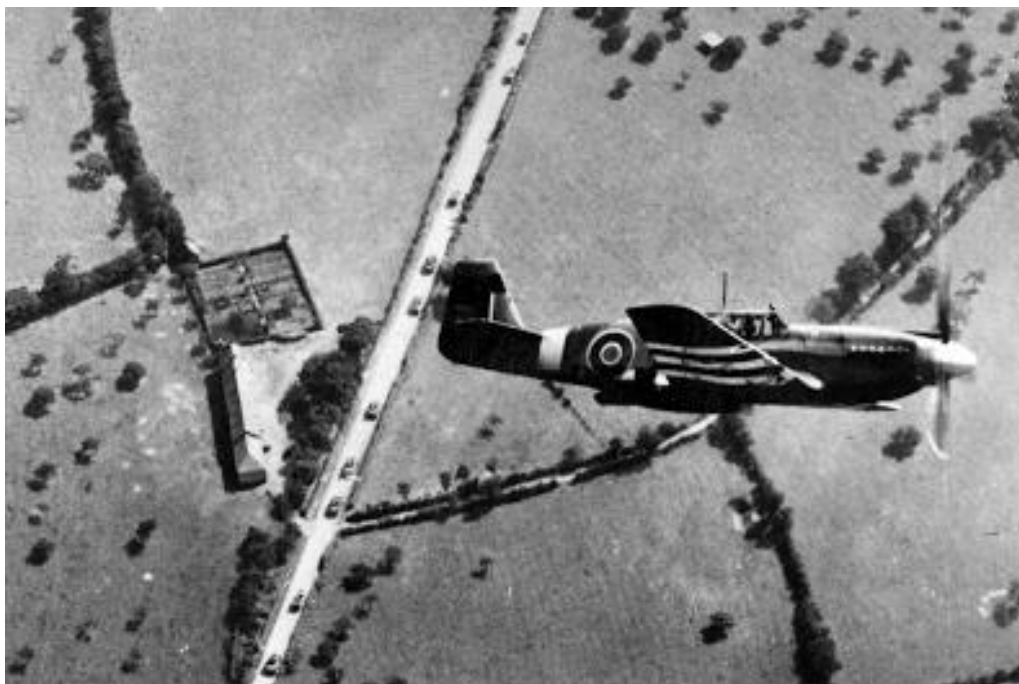
Hence, although only part a severely degraded SS Panzer Corps confronted the British airborne at Arnhem, this formation would still prove to be a formidable adversary. Equally, having also been assigned the status of 'alert units', their component battalions were prepared to react quickly to emerging threats.⁽³⁹⁾ Ultimately, at Arnhem, 9th SS Panzer Division formed a highly experienced nucleus around which a far larger German force was constructed, while 10th SS Panzer Division brought similar combat experience to bear during their protracted defence of the Nijmegen bridges. And yet Montgomery's subsequent reflections still tend to exaggerate the role of II SS Panzer Corps in the Allied defeat. In part, it was convenient to maintain that the gallant British airborne had faced overwhelming odds, represented by two divisions of first-rate German troops equipped with armour and heavy weaponry in abundance. Nevertheless, like so many others, he lacked an accurate understanding of how the Germans had really won the Battle of Arnhem.

The air reconnaissance resources available before Market Garden were divided between the mainly tactical squadrons, based on the continent, and the strategic squadrons of 106 Group in Southern England. The squadrons in France and Belgium came under Second Tactical Air Force (Second TAF), which operated in support of 21st Army Group; within Second TAF, 83 Group provided air reconnaissance for Second Army. They did not execute tasking for the airborne forces, which were still based in the UK. Intelligence derived from imagery captured on the continent (and other sources) could, however, be passed back to the airborne.

The volume of air reconnaissance activity undertaken by 83 Group over Holland in the days preceding Market Garden appears to have been limited, considering the importance of the operation. Montgomery's relations with the commander of Second TAF, Air Marshal Sir Arthur Coningham, were poor, and he was largely excluded from the planning process.⁽⁴⁰⁾ Such airbases as were available in Belgium during the first half of September were predominantly, of necessity, reserved for combat aircraft, and only a single reconnaissance squadron was deployed forward. The remainder flew from Avrilly, which was south of the River Seine – a considerable distance from Arnhem. Adverse weather also caused several missions to be cancelled. Furthermore, the RAF reconnaissance aircraft were confronted by an adversary that was, by this stage of the war, highly proficient in the use of camouflage, concealment and dispersal, tactics all too easily effected in the heavily wooded and urban environments that typified Allied objectives in Market Garden. In these circumstances, it is hardly surprising that the reconnaissance missions flown by 83 Group over Arnhem observed little activity of significance on the ground.⁽⁴¹⁾



Air Marshal Coningham (far left) of Second Tactical Air Force and Montgomery (far right), with King George VI, Brussels, October 1944



Second TAF Mustang over Normandy, 1944



A 541 Squadron Spitfire XI



Low-level oblique image of the Arnhem landings, 17 September 1944

As for the airborne, given their obvious requirement for air reconnaissance support, it was agreed that they should request missions from the strategic squadrons based at RAF Benson. For Holland, this chiefly meant 541 Squadron, which was equipped with Spitfires and had a particular responsibility for the Low Countries. As a strategic squadron, 541 inevitably had other fish to fry: they were normally reserved for gathering imagery of larger fixed facilities and genuinely strategic targets and were rarely tasked with the provision of tactical battlefield intelligence.(42)

Measures were taken to increase the availability of tactical air reconnaissance for the airborne via the temporary return of a detachment from the continent, but this occurred only when Market Garden began. Although German flak claimed two of their aircraft, the detachment subsequently captured some of the most famous low-level images of the Arnhem battle, depicting both the landings and the fighting at the bridge; these photographs were not taken by 541 Squadron.(43)

Hence, the resources directly available to the airborne were quite limited before the operation, and there were further restrictions on supporting air reconnaissance activity. Poor weather prevented any collection over Holland on 7, 8, 14 and 15 September.(44) Nevertheless, at first, the RAF was still in a position to accept quite specialised work for the airborne intelligence staff at very short notice. Immediately after Operation Comet was approved, 541 Squadron flew several low-level sorties, focusing on the main bridge objectives at Arnhem, Nijmegen and Grave. These missions were exceptional: the vast majority of 541 Squadron tasking was executed at high altitude and obtained vertical imagery. The use of low-level tactics to take oblique-angle photographs was clearly recorded in the squadron diary and the imagery has also been preserved in the UK archives.(45)



541 Squadron low-level oblique, Arnhem bridge, 6 September 1944



541 Squadron low-level oblique, Nijmegen bridge, 6 September 1944

Then, on 8 September, the situation was radically altered by the launch of the first V-2 missiles against London. The hunt of V-2 launchers, already underway, was intensified to cover the entirety of Western Holland, leaving even less capacity available for the airborne.(46) Coverage of Arnhem was only updated intermittently by 541 Squadron in the period 9-13 September, although some further missions were flown by the tactical squadrons on the continent.(47) The second adverse weather period subsequently intervened, although it is questionable whether intelligence gathered between, say, 14 and 16 September would have been of much practical value, in any case. Airborne operation plans are notoriously inflexible and the main features of Operation Market Garden were set in stone several days before it was launched.(48)

This basic timeline must be kept in mind when we consider the Arnhem air reconnaissance story in more detail. As we have already noted, it is a story dominated by a single low-level mission that allegedly succeeded in capturing imagery of German tanks assumed to belong to II SS Panzer Corps. This one 'dicing' sortie, although first described in print in 1962, did not receive close attention until the publication of Cornelius Ryan's book, *A Bridge Too Far*, in 1974.(49) Both the mission and its aftermath were then subject to highly emotive dramatization in the film of the same name. Ryan's account was based entirely on an interview with the British Airborne Corps intelligence chief, Major (later Sir) Brian Urquhart.

Urquhart recalled harbouring deep misgivings about the Arnhem plan, which seriously underestimated the likely strength of German opposition in Holland, in his view. His anxiety was increased shortly after Market Garden was authorised, when he noticed in a 21st Army Group report a reference to the possibility that II SS Panzer Corps was refitting in the Arnhem area. Deeply perturbed, he showed the report to the Airborne Corps commander, Lieutenant General FAM 'Boy' Browning, and his Chief of Staff, but they appeared uninterested.

When I informed General Browning and Gordon Walch of this development, they seemed little concerned and became quite annoyed when I insisted on the danger. They said, as I remember, that I should not worry unduly, that the reports were probably wrong, and that in any case the German troops were refitting and not up to much fighting. This reaction confirmed my worst suspicions about the attitude of Browning and his staff.(50)

Urquhart therefore sought to prove that II SS Panzer Corps was in the Arnhem area by obtaining photographic evidence. Conventional high-level reconnaissance imagery had shown no sign of German armour, but he believed that oblique-angle photographs taken at low altitude might paint a very different picture. He therefore requested a low-level sortie, which was flown by a Spitfire squadron based at RAF Benson, 'the acknowledged experts in this art'. He evidently hoped that, if the presence of tanks was confirmed by visual evidence, the Allied plan would be substantially revised.(51) Urquhart apparently led Cornelius Ryan to believe that the Arnhem reconnaissance task was subsidiary to the primary mission objective, which involved collection over Western Holland. Indeed, Ryan wrote that the photographs were taken by an aircraft 'returning from The Hague' – an awkward geographical concept. According to Ryan, the Spitfire then executed 'a low-level sweep across the Arnhem area', the requested imagery was duly obtained, and Urquhart was supplied with five photographs.(52) His memoirs take up the story.

The pictures when they arrived confirmed my worst fears. There were German tanks and armoured vehicles parked under the trees within easy range of 1st Airborne Division's main dropping zone.(53)

In later correspondence with the historian Martin Middlebrook, he identified the tanks as Panzer IIIs and Panzer IVs.(54) With hindsight, it might be suggested that the historical community should have taken this clue far more seriously by considering where tanks of this type were actually encountered by Allied forces on the day Market Garden was launched.



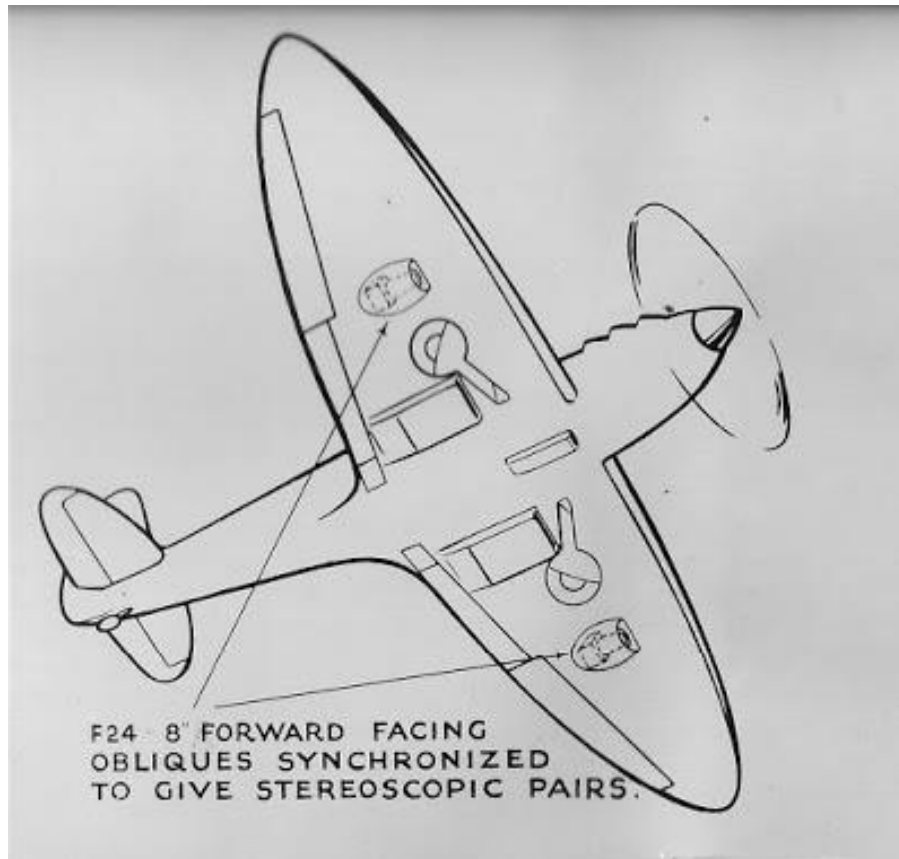
Browning

Urquhart rushed to Browning with this new evidence, 'only to be treated once again as a nervous child suffering from a nightmare.'⁽⁵⁵⁾ Browning showed little interest and allegedly expressed doubts that the tanks were serviceable. There were no changes to the Market Garden plan, and Urquhart was soon afterwards approached by Colonel Arthur Eagger, chief medical officer at British Airborne Corps headquarters, who told him he was suffering from nervous exhaustion and ordered him to take sick leave.⁽⁵⁶⁾

Many historians have accepted this disturbing account at face value, yet it raises several questions that have proved extremely difficult to answer. The order of events is questionable, in certain respects, particularly the claim that the first reports mentioning the presence of II SS Panzer Corps at Arnhem appeared after Market Garden was approved. In fact, as we have seen, the official records show that they were circulated during the planning for Operation Comet, several days earlier. Indeed, Comet was enlarged into Market to deal with the enemy threat – an important point that is completely overlooked in Urquhart's account.

This is linked to the implication that Browning somehow ignored or suppressed the intelligence. For it was on 7 September that Browning himself informed the more senior 1st Airborne Division officers of the reported movement of German armour to Arnhem. Within 1st Airborne, the task of capturing the Arnhem road bridge (and the rail bridge) on 17 September was assigned to 1 Parachute Brigade, commanded by Brigadier Gerald Lathbury. After the war, Lathbury was contacted by the official Cabinet Office historian and asked when and how he had first learnt that II SS Panzer Corps was in the Arnhem area. In his reply, he referred to the planning for Comet. 'During the initial briefing by the Corps Commander [Browning] the suspected presence of II [SS] Panzer Corps refitting in the area was mentioned.' The basis for Browning's statement would almost certainly have been the 5-6 September Enigma decrypts, suitably sanitised. Lathbury went on to say that no further reference to this formation had been contained in later briefings. 'I certainly never considered it in my plan.'⁽⁵⁷⁾ Nevertheless, the warning was repeated in 1st Airborne Division's Planning Intelligence Summary of 7 September.⁽⁵⁸⁾

Third, and most significantly, there is a fundamental mismatch between the capabilities of the RAF Benson squadrons – the only reconnaissance squadrons that operated in support of the airborne forces – and the task that Urquhart described. To capture oblique imagery at low level, 541 Squadron Spitfires were equipped with wing-mounted forward-facing synchronised 8-inch lens cameras. As they only produced photographs of a limited area, the target location had to be established and briefed to the pilot in advance and the aircraft had to be flown directly towards the target when the photographs were taken.⁽⁵⁹⁾



541 Squadron camera configuration for oblique photography



Wing-mounted forward-facing camera; note flak damage

Consequently, this technique was reserved for fixed points of interest. Indeed, of the few low-level missions flown by 541 Squadron in the summer of 1944, not one was

launched to photograph mobile tactical targets, such as mechanised ground formations. In truth, the squadron did *not* possess an expertise in this field: it was after all, a strategic reconnaissance squadron. In August, for example, 541's objectives at low level included the Wizernes V-2 site, an airfield, cave entrances, a radar mast and docks.⁽⁶⁰⁾ Obliques of mobile ground targets were captured by tactical reconnaissance squadrons based on the continent, but with rear-mounted sideways-facing cameras fitted in aircraft that flew parallel to target areas – not towards a specific pinpoint.⁽⁶¹⁾ The 541 Squadron Spitfires did not use this camera configuration.

In short, to stand any realistic chance of obtaining low-level obliques showing elements of II SS Panzer Corps, 541 Squadron would have had to possess other information identifying the exact location of the enemy formation at some kind of fixed facility, such as a barracks. This hardly accords with the notion of a 'low-level sweep across the Arnhem area.' The Dutch had reported the arrival of panzer troops at specific Arnhem barracks, but Urquhart's account clearly placed the tanks in a more tactical setting, 'parked under trees'. Moreover, even if he had obtained detailed intelligence of where the armour was positioned at a particular time, subsequent relocation was not merely possible but highly probable while the reconnaissance sortie was being requested, approved and mounted.

This raises the question of whether the mission, as described, would even have been officially sanctioned, for it would have involved considerable risks without much likelihood of operational gain. Low-level missions were nicknamed 'dicing' quite literally because they involved dicing with death. In this regard, it is important to remember that all requests for air reconnaissance tasks involving the 106 Group squadrons had to be approved by a body named the Joint Photographic Reconnaissance Committee (JPRC). Located at Benson, the JPRC was a subcommittee of the Joint Intelligence Committee, through which it was responsible to the Chiefs of Staff. With tri-service and American membership, it was continuously briefed on the development of operational planning and met twice per day to assess requests for cover and prioritise between reconnaissance tasks. The JPRC had also to clarify poorly-worded or ill-judged applications.

For instance, they were able to reduce some vague enquiry to terms of accurate co-ordinates ... By the time, therefore, that a job left the

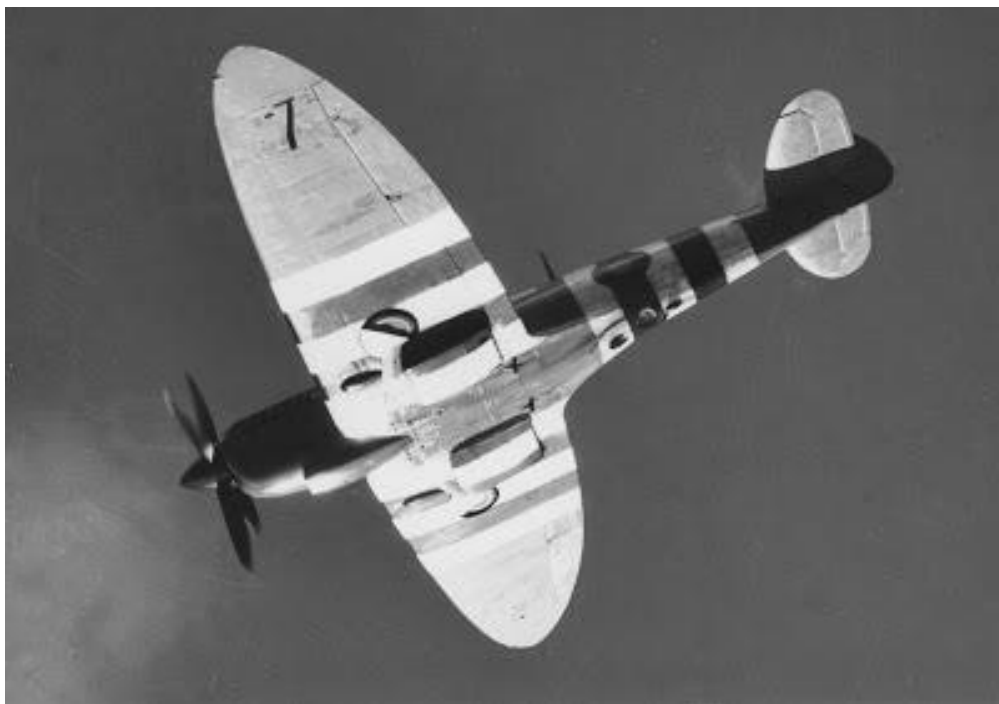
Joint Photographic Reconnaissance Committee, it was certain that it was really necessary, it's degree of importance was known, and it was reduced to accurate map co-ordinates and scale.(62)

It is, quite simply, unthinkable that the JPRC would have acceded to a request for a low-level air reconnaissance mission to search some general area around Arnhem for German armour, when the proposed task would have been carried out by a squadron that had no established low-level capability against mobile tactical targets and was only equipped to take low obliques of fixed points of interest. The probability of mission success would have been minimal under any circumstances; it would have been reduced still further by the densely forested terrain north of Arnhem, which offered the Germans abundant scope for concealment. In actual fact, when 541 Squadron was required to photograph smaller, tactical targets, such as V-2 launchers, without specific knowledge of their whereabouts, their approach was overwhelmingly to operate at high altitude using cameras with 36-inch lenses to take vertical imagery of areas, rather than pinpoints.(63)

Urquhart's account is therefore somewhat perplexing. Further problems arise if we seek to document the events he described. Several extensive searches for the photographs have failed to locate them. Ostensibly, this might not seem surprising, as most tactical reconnaissance material was destroyed after the war, but Urquhart insisted that the Arnhem sortie was flown by a Spitfire squadron based at Benson; this would almost certainly mean 541 Squadron. Far more of their imagery survived within the UK archives, but no oblique photographs showing tanks at Arnhem. In addition, although the Benson missions were systematically recorded at squadron and group level, not one record matches the sortie Urquhart described. The low-level missions targeting the bridges on 6 September were scrupulously noted down, but all other recorded reconnaissance sorties over Arnhem were flown at higher altitudes and captured vertical imagery. Equally, it has proved impossible as yet to locate an interpretation report derived from a low-level mission that photographed German armour near Arnhem before Market Garden.



The first air image of a V2 launch – a high-altitude vertical shot



A 541 Squadron Spitfire equipped to capture high-altitude vertical imagery with cameras mounted in the lower rear fuselage

In time, this total lack of evidence inevitably generated scepticism and some even questioned whether the Spitfire sortie had been flown at all. It was only quite recently that supporting evidence was supplied by Major Anthony Hibbert, a brigade major with First Airborne Division at Arnhem. Hibbert recalled that Urquhart had shown him photographs of tanks ‘tucked in underneath woods’ on or around 12 September, and specifically remembered seeing Panzer IVs.⁽⁶⁴⁾ This was certainly an interesting development, but it still did not provide a means to solve the mystery once and for all.

The real breakthrough occurred only after Dutch holdings of Allied air reconnaissance imagery were made available online in 2014. The Allies gave a significant quantity of imagery to Holland after the war to assist with reconstruction and a range of postwar economic and legal tasks. For many missions, duplicate imagery was not retained in the UK; a substantial proportion of the Dutch collection is thus unique.⁽⁶⁵⁾ However, the photographs were held in the form of hard-copy prints, which could not easily be enlarged. Only their digitisation provided the means to achieve rapid enlargement. It should be stressed here that the photographs were scanned from prints and thus lack the clarity of the images that would have been available to interpreters in 1944. Then, it would have been possible to produce enlargements directly from the negatives, a facility that generated clearer and larger blow-ups than we can obtain from digital imagery today, before losing resolution. Nevertheless, digitisation still allowed the Dutch imagery to be examined in far greater detail than had previously been readily available to researchers.

Among the material accessible online are the only surviving photographs from a 541 Squadron mission, 106G/2816, flown from Benson on 12 September by Flight Lieutenant Brian Fuge in Spitfire XI PL907; Fuge was airborne for two hours and fifty minutes, taking off at 10.05 and landing at 12.55. The mission was flown at high altitude and captured vertical imagery with a 36-inch lens camera. Without doubt, it was flown for the airborne forces, for its geographical parameters were confined to the Arnhem and Nijmegen areas.⁽⁶⁶⁾ (see Map 1)



Flight Lieutenant Brian Fuge, 1944

The Spitfire routed east, north of Arnhem and across the main Arnhem-Appeldoorn road, before banking and commencing a westward run just south of the village of Loenen, orientated slightly north of the Luftwaffe airfield at Deelen. Seconds later, Fuge was flying over woodland known as the Deelerwoud, northeast of the airfield. His first frame was numbered 4001;(67) frame 4015, his fifteenth (out of a mission total of 942 frames) differed from every other in so far as it contained visible markings and lettering. At first, this was assumed to be wartime lettering relating to an interpretation report, and this proved to be one of the most ironic features of the Arnhem air reconnaissance story. In fact, the lettering on the photograph was added by Dutch

cartographers after the war. Historical attention was thereby attracted to the right photograph but for the wrong reasons.(68) (see Map 2)

To complicate matters further, no intelligence documentation relating to frame 4015 could be traced. Nevertheless, a high-resolution download of the photograph revealed the presence of multiple German armoured fighting vehicles (AFVs) and other vehicles near the intersection of two woodland tracks, apparently halted while moving south. Some are partly obscured by tree cover, while others are in the open; there is little clear sign of camouflage measures. While there is insufficient resolution and too much cover from trees or shadow to provide more than a few reliable identifications, the larger tanks include Panzer IVs of early design, with short-barrelled 75mm guns; there are also smaller tanks, including Panzer IIIs, which are, again, early models equipped with 37mm guns. Some of the tanks have rotated turrets, probably to create space for maintenance work or fuelling – a routine procedure. There are clear signs of activity behind at least two tanks.

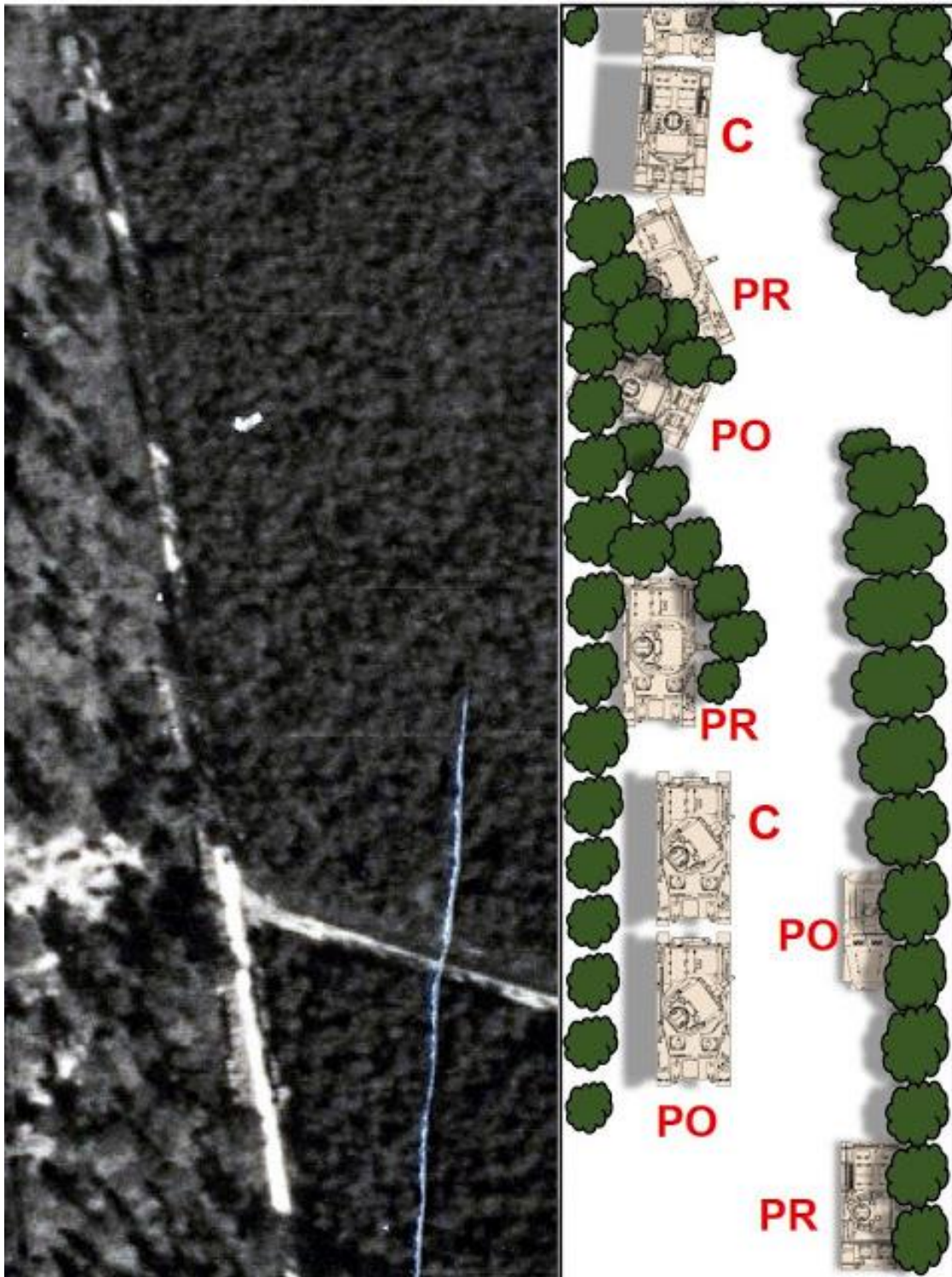
Another AFV is visible near the intersection, which is possibly a half-track with a short-barrelled rear-mounted gun. This might be an SDKFZ 250/8 or 251/9. Further up the track, moving through the woods, is yet another turreted AFV, which is impossible to identify. Of the other vehicles visible in the photograph, none is readily identifiable. A number of large rectangular objects can be seen, which are probably supply dumps. Still further to the north, a second AFV with a rear-mounted turret or gun is visible in the open, possibly stationary, and more vehicles can just be seen emerging from the trees.



Mission 106G/2816 of 12 September 1944, frame 4015

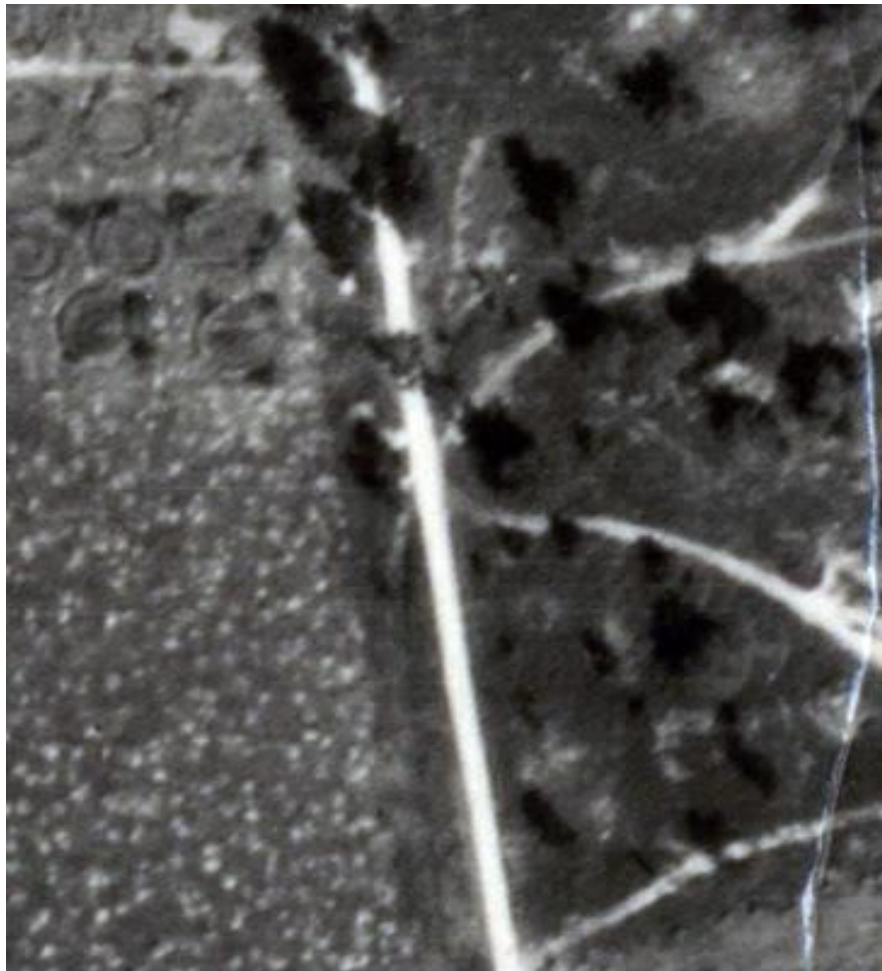


Frame 4015, German armoured column and supply dumps in the Deelerwoud



Due to lack of resolution, it is impossible to make clear enlargements of the track intersection; this diagram was prepared using digital enlargement and enhancement to provide identifications for the vehicles as Certain (C), Probable (P) and Possible (PO)

As for unit identifications, it has only been possible to establish a very tenuous connection between the vehicles in the photograph and German elements known to have deployed armour at Arnhem during Market Garden. The reconnaissance battalion of 9th SS Panzer Division, under Hauptsturmführer Viktor Graebner, was positioned at the village of Hoenderloo, a short distance north of Deelen, before the operation. Indeed, the German vehicles visible in the photograph were parked or moving along a track that ran directly south from the village. The battalion did possess a number of SDKFZ 250s and 251s, but there is no record suggesting the involvement of early type Panzer IIIs or IVs in the Arnhem battle. More modern Mk IIIs and IVs only arrived from Germany on 19 September, two days after the airborne landings began.⁽⁶⁹⁾ Probably, then, the German armour did not belong to II SS Panzer Corps.



*Detail from frame 4015: a single AFV on the track
north of the Deelerwoud*

There was, however, another formation in this area of Holland that possessed a considerable number of older tanks. This was the Hermann Goering Parachute Panzer Training and Replacement Regiment, which was responsible for supplying replacements to its parent division – the Hermann Goering Parachute Panzer Division, then fighting in the East. The regiment's Second Battalion was tasked with training panzer, panzer-grenadier, self-propelled artillery and self-propelled anti-tank gun personnel. Based at Utrecht, it is recorded that they had previously used Apeldoorn and other locations north of Arnhem for training purposes.

In the first week of September, the regiment became part of the 1st Parachute Army, formed under Generaloberst Student with the aim of constructing a defensive line on the Albert Canal to block the British advance from Antwerp.⁽⁷⁰⁾ Soon afterwards, elements drawn from the Training and Replacement Regiment were sent south. They suffered heavy losses fighting at Hechtel between the 7th and the 10th but managed to extricate at least some tanks.

On the 11th, the day before the Spitfire mission, all remaining units were ordered to move from their base areas to Eindhoven. As their commanding officer noted in his diary, 'Even the recruits are to be sent in. Otherwise, there is nothing more available.' What remained of the Second Battalion was positioned north of Eindhoven.⁽⁷¹⁾ It is known that they were equipped with early model Panzer IIIs and IVs, as these tanks were encountered near Son by 101st Airborne Division soon after the first landings on the 17th.⁽⁷²⁾ Tanks and self-propelled guns were also spotted by a 2nd TAF Mosquito on the 16th in the area where the regiment was deployed.⁽⁷³⁾

A possible scenario is that at least part of the Second Battalion was held in the rear as a reserve during the fighting at Hechtel – perhaps the less battle-worthy of their six companies – and was training north of Arnhem when orders for the move came through. It is plausible that, in preparation, they refuelled and restocked from the dumps near Deelen, where they were photographed by the Spitfire.



*Early model Panzer IV of the Hermann Goering Parachute
Panzer Training and Replacement Regiment*



*One of the Hermann Goering Regiment Panzer IIIs
knocked out near Son on 17 September 1944*

After the reconnaissance mission was completed and Flight Lieutenant Fuge landed at Benson, he would have been debriefed while the film was developed at the airfield

Photographic Section on a Kodak continuous processing machine, capable of producing as many as 400 negatives per hour. The negatives would then have been viewed by interpretation officers at the First Phase Section, who had the job of selecting shots of particular importance for rush printing, before the routine printing of the entire film.

From these selected images, a first-phase interpretation report would have been written and dispatched by teleprinter on a so-called Form White to interested parties. At Benson, the average time between the receipt of photographs by interpreters and the issue of the Form White was between half and one hour. Information of a particularly urgent nature was telephoned to recipients in considerably less time.(74) In the case of Fuge's mission, the direct link between frame 4015 and the first-phase report is indicated by the 106 Group records, which record that Deelen was the subject of the Form White.(75)



First phase section, RAF Benson

If this episode is unrelated to the sortie recalled by Brian Urquhart, it would mean that two very similar events occurred at around the same time, one of which has featured

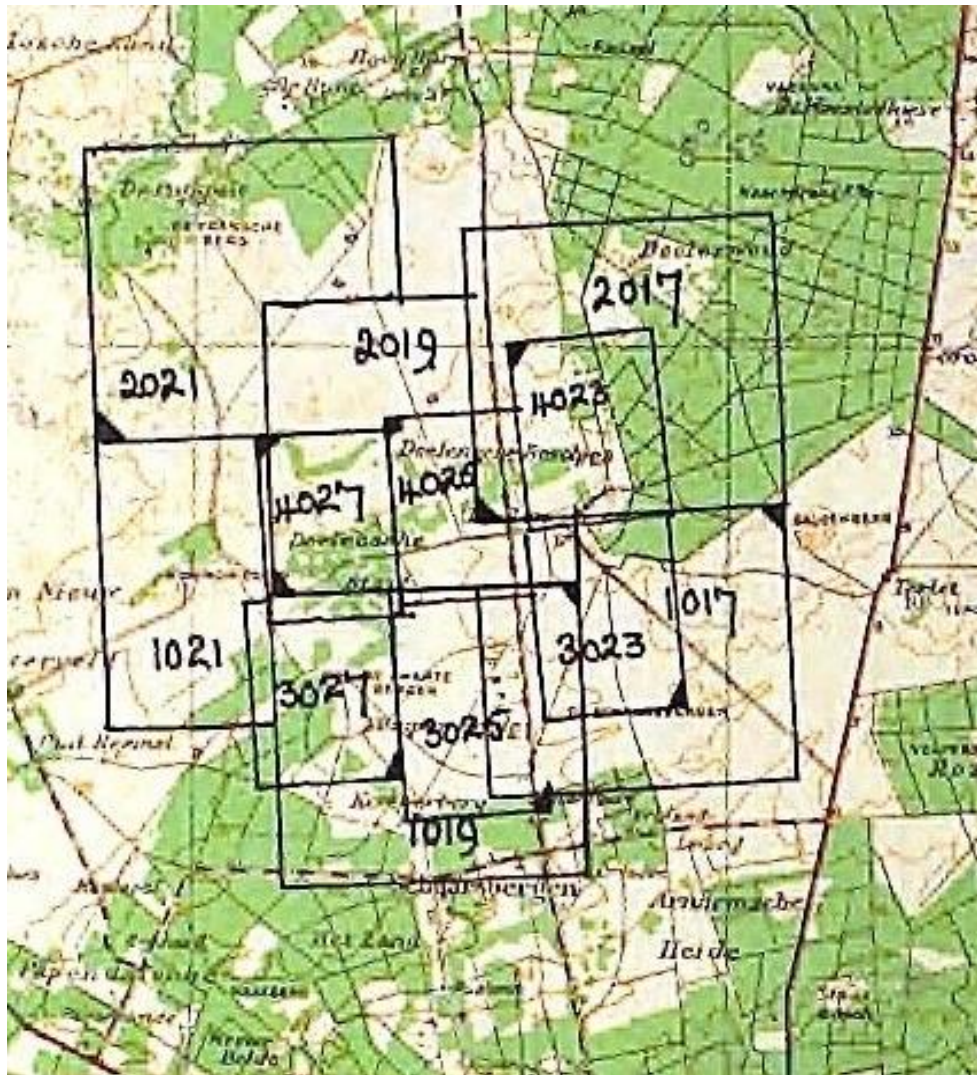
in almost every published work on Market Garden, while the other has been entirely hidden from history until today. This is wholly implausible. While British Airborne Corps intelligence undoubtedly requested 106G/2816 and presumably received the Form White, Urquhart only ever recalled one occasion when German armour was photographed near Arnhem. It might just be that, on the basis of the imagery, he managed to arrange a low-level sortie that was not subject to the normal JPRC processes and which was never recorded in the squadron or group records. However, this seems equally unlikely, given the lack of low-level tactical reconnaissance expertise at RAF Benson, the intense pressure imposed on the squadrons by the V-2 search and potential objections on the grounds that the enemy vehicles would have moved elsewhere by the time the sortie was flown.

More probably, the five photographs supplied to Urquhart were not, in fact, photographs at all; they were enlargements showing parts of the single high-level vertical image, frame 4015, which clearly depicted the 'tanks and armoured vehicles parked under the trees' that he and Hibbert recalled, and the Panzer IIIs and IVs that they specifically identified. The supposition that the imagery was captured at low level may perhaps have stemmed from the scale of the enlargements, for the German vehicles are difficult to see unless this picture is blown up to the greatest possible extent. Alternatively, Urquhart may have requested a low-level sortie that was not, ultimately, flown; or he may, looking back, have confused this episode with the earlier 541 Squadron tasking to photograph the Arnhem, Nijmegen and Grave bridges. As the story of the mission gained in prominence, correction might in due course have been supplied by the pilot himself, had he survived the war, but Flight Lieutenant Fuge sadly lost his life during another reconnaissance mission barely six weeks before hostilities ended.(76)

Ironically, many of the German vehicles photographed in the Deelerwoud on 12 September 1944 would probably not have been visible in low oblique imagery. The low-level approach would only have paid dividends if the tanks had been positioned on the edge of woods, adjacent to open ground, in the manner depicted in the film, *A Bridge Too Far*. Flying across open terrain towards the woods, the *Bridge Too Far* Spitfire possessed a clear line of sight to tanks positioned along the treeline. But the Germans were predominantly parked in the middle of woodland, where a low

camera angle would have made the tree cover particularly effective – a solid barrier of trunks, branches and foliage. By contrast, from a vertical angle, the trees afforded far less protection from the eye in the sky.

A second high-altitude air reconnaissance mission photographed exactly the same part of the Deelerwoud later that day. In this instance, the task was assigned to a 544 Squadron Mosquito XVI, MM285, crewed by Flight Lieutenant PT Pratt and Pilot Officer EH Grennan. The aircraft took off at 1-35 pm and initially flew to Germany to gather imagery of two predominantly urban targets – Osnabruck and Munster; it then transited back across Holland to execute tasking over The Hague and Rotterdam, presumably in search of V-2 launchers. But, *en route* from Germany, the Mosquito also photographed Deelen airfield.⁽⁷⁷⁾ A plot supplied by the National Collection of Aerial Photography (NCAP) at Edinburgh records the track flown over Deelen by the Mosquito, and shows that its cameras were activated directly over the woods where the German unit had previously been spotted. The Allied Central Interpretation Unit (ACIU) plotters had also marked this area with an 'A', indicating that an interpretation report was prepared to describe an object (or objects) of interest at that specific location.⁽⁷⁸⁾



Overlay plot for the 544 Mosquito imagery over Deelen; note the 'A' marked in frame 4023

Regrettably, the marked frame is missing from the Edinburgh collection. Indeed, it is the only photograph that is not present among the group of images captured by the Mosquito over Deelen on 12 September. Astonishing as this might seem, many equally historic frames have unfortunately not found their way into the UK's national air imagery collection. As the photographs passed through a number of different hands before reaching their current home, there was ample opportunity for interested individuals to remove them. The remaining three Mosquito photos covering our particular area of interest are inferior in quality to the images captured by the Spitfire, and it appears that the German presence had been scaled down. It is impossible to identify any vehicles with certainty, although the suspected supply dumps can still

easily be seen. Again, we must remember that better enlargements would have been available at the time, which might have revealed more.

How significant was the imagery captured by the Allies on 12 September 1944? One possible reading might well be that the German forces shown in the photograph posed a major threat to Allied plans. The movement of German armour to Arnhem had first been suggested by signals intelligence, then by the Dutch resistance, now the Allies also possessed visual confirmation of an enemy armoured presence. In all, around 30 vehicles could be counted, including tanks and at least one armoured half-track – possibly more. The supply dumps might well have indicated that these forces were stationed in the immediate vicinity and were not just passing through. Moreover, if the armour was indicative of the presence of 9th or 10th SS Panzer Division, there would probably also be some motorised infantry, artillery and support elements nearby.

Yet, predictably, the issues were by no means clear-cut. After the ULTRA messages of 5 and 6 September, no further signals intelligence was received to the effect that II SS Panzer Corps was in the Arnhem area. As for the Dutch resistance reports, 21st Army Group apparently had reason to view them with some scepticism, and Montgomery's staff retained their conviction that II SS Panzer Corps could no longer fight effectively, in any case. The proposition that the German unit in the photograph lacked much combat capability or was nothing more than a training outfit might well have received some support from the absence of camouflage and the presence of older equipment. Most front-line German armoured vehicles were permanently covered with bushes and branches by this stage of the war, due to the threat of air attack. Some early model Panzer IVs had been employed by 21st Panzer Division in Normandy, but the vast majority of front-line Panzer IVs were equipped with long-barrelled guns by September 1944; Panzer IIIs were no longer in front-line service, and the detachment that reached Arnhem from Germany on 19 September was drawn from a training unit.(79)

It is also important to remember that Market Garden had been enlarged from one to three airborne divisions on the basis of the increased enemy threat, and that some armoured opposition was always expected. For this reason, 1st Airborne landed at Arnhem on 17 September equipped with anti-tank guns and other anti-armour

weapons in considerable quantity.(80) When Graebner's reconnaissance battalion was captured by air imagery during the Arnhem battle, the low-level oblique photographs (taken by a 2nd TAF aircraft with a rear-mounted sideways-facing camera) showed a tangled mass of destroyed vehicles and dead SS troops on the road bridge, the victims of a misguided attempt to recapture the bridge that was comprehensively defeated by 2 PARA. Armoured opposition came as no surprise to 1st Airborne. Rather, they were undone by the speed and scale of the German response and by Second Army's failure to relieve them.(81)

As for the ageing tanks of the Hermann Goering Parachute Panzer Training and Replacement Regiment, their movement south provides still more irony in so far as it conformed with the prevailing British perception that German forces were mainly being deployed in the front-line area, as opposed to rear locations like Arnhem, and they did not exert any influence on events at Son. Confronted by 101st Airborne Division's landings, they attempted to withdraw, only for three Panzer IIIs to be knocked out by Allied fighter-bombers. A fourth tank ran into American paratroops slightly further north, at Veghel, but escaped under a hail of bazooka and small-arms fire. However, Hermann Goering troops are said to have been responsible for demolishing the bridge over the Wilhelmina Canal at Son, so delaying the British ground advance to some extent, and the regiment subsequently fought with distinction in defence of the Nijmegen road bridge, albeit under the command of the SS. At least one Panzer II participated in this action.(82)

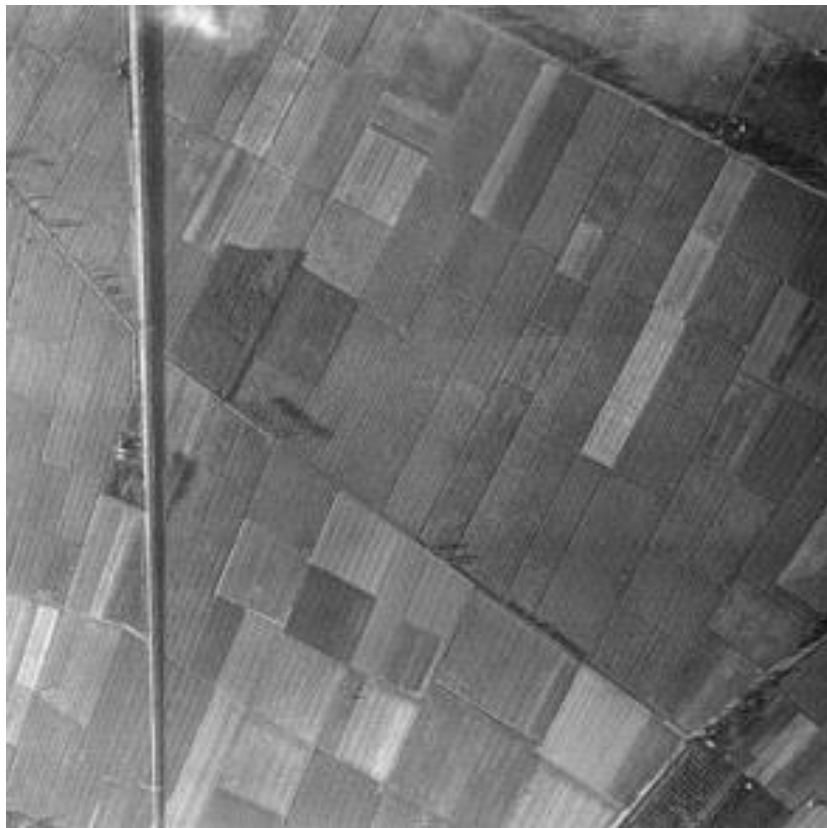


Hermann Goering Regiment Panzer II, Nijmegen

The many other photographs taken over Holland in the days leading up to Market Garden contained a great deal of useful intelligence, but its impact on Allied planning varied significantly. Air imagery captured the terrain characteristics of the prospective battle area with particular clarity, showing the very sharp contrast at Arnhem between the low, flat polder land south of the Neder Rhine, with its multiplicity of dykes and drainage ditches, and the rising and densely wooded countryside on the north bank. To link up with the airborne, Second Army's XXX Corps, headed by the Guards Armoured Division, had to advance along a single, narrow road, raised above the level of the surrounding polder, straight towards a near perfect defensive position – hills fronted by a major water obstacle, rather like an enormous medieval moat. The commander of 4 Parachute Brigade at Arnhem, Brigadier (later General Sir) John Hackett, described the terrain thus:

Standing on the high ground at Westerbouwing for the first time a few years ago, moreover, and looking south, I could not help thinking that, with observation from there, well-placed artillery on the north bank of the Rhine could totally control movement along that road for many miles. The Guards Armoured Division was here set an impossible task. Why was this road used as the main axis anyway?(83)

This was always going to be difficult fighting terrain, certain to impede movement and manoeuvre; but it also made Arnhem a very problematic airborne objective. The photographs, supported by the available mapping and intelligence from the Dutch, disclosed terrain in the immediate vicinity of the road bridge completely unsuitable for the large-scale glider landings that were a central feature of the British plan. Annex A to 1st Airborne Division's Planning Intelligence Summary of 5 September 1944 stated that 'the areas between the Waal and the [Lower] Rhine and south of the Waal are mainly flat, dyked clay polderland, intersected by innumerable drainage ditches.' According to the 7 September Intelligence Summary, the smallest of these ditches were 5-6 feet wide, while the largest were 12 feet wide. 'The wider ditches may be vaulted with a 12-foot pole, which is the practice in the Royal Dutch Army.'(84)



Air imagery reinforced other topographical intelligence; the Arnhem bridge was shielded by the city, by dense woodland, and polder intersected by an enormous network of drainage ditches

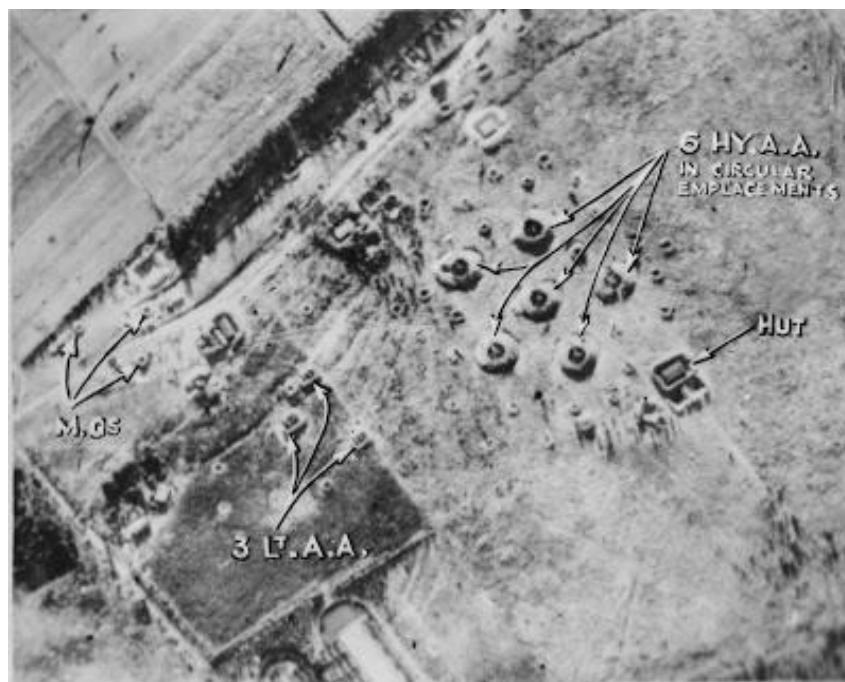
A post-war official account refers in even more detail to the terrain features south of Arnhem, recording that 'The land here is divided by ditches into areas of around 50 to 100 metres in width and 100-200 metres long. The ditches are 2-3 metres wide and 1½ deep with usually ½ metre of water in them.'(85) No responsible Allied commander could conceivably have authorised a substantial assault glider landing into such extensively subdivided country. To have done so would have involved a high risk of serious damage to the gliders and their cargoes, injury or worse to their passengers, and acute difficulties unloading and transporting vital equipment.(86) Equally, landings would hardly have been practicable in the urbanised area on the north bank of the river, nor could they have been safely executed in the thick woodland that surrounded Arnhem. Hence, there was no alternative to the selection of more distant landing areas, with all the obvious disadvantages involved.(87)

Air imagery of German flak defences in the Arnhem and Nijmegen areas reinforced this basic message. A substantial build-up was revealed by the photographs and was noted in successive interpretation reports. On 6 September, one report based on air imagery noted 'heavy concentrations at Deelen airfield, Arnhem and Nijmegen – respectively 30 light and 24 heavy guns, 36 light and 36 heavy guns, 24 light and 12 heavy guns.' These numbers were expected to increase.(88) On the 7th, XXX Corps recorded that heavy and light flak at both Arnhem and Nijmegen was increasing very considerably. 'Guns getting into position (with vehicles and pits under construction) can be seen on several photos and there is railway flak at Arnhem.'(89)

Some reorganisation of Deelen's flak batteries evidently occurred in the aftermath of a Bomber Command raid on the airfield, mounted on 3 September, and it was at first thought that the airfield's anti-aircraft defences had been removed. However, this assessment was revised on the basis of later air reconnaissance. An estimate produced by First Allied Airborne Army on 12 September recorded: 'Flak is apparently still present in rather large quantity, there being seventeen (17) heavy guns and fifty-five (55) light guns shown as [*sic*] occupied positions on the latest photo cover.'(90)



*Heavy anti-aircraft artillery battery north of Arnhem,
unoccupied on 6 September*



The same battery, occupied by 12 September

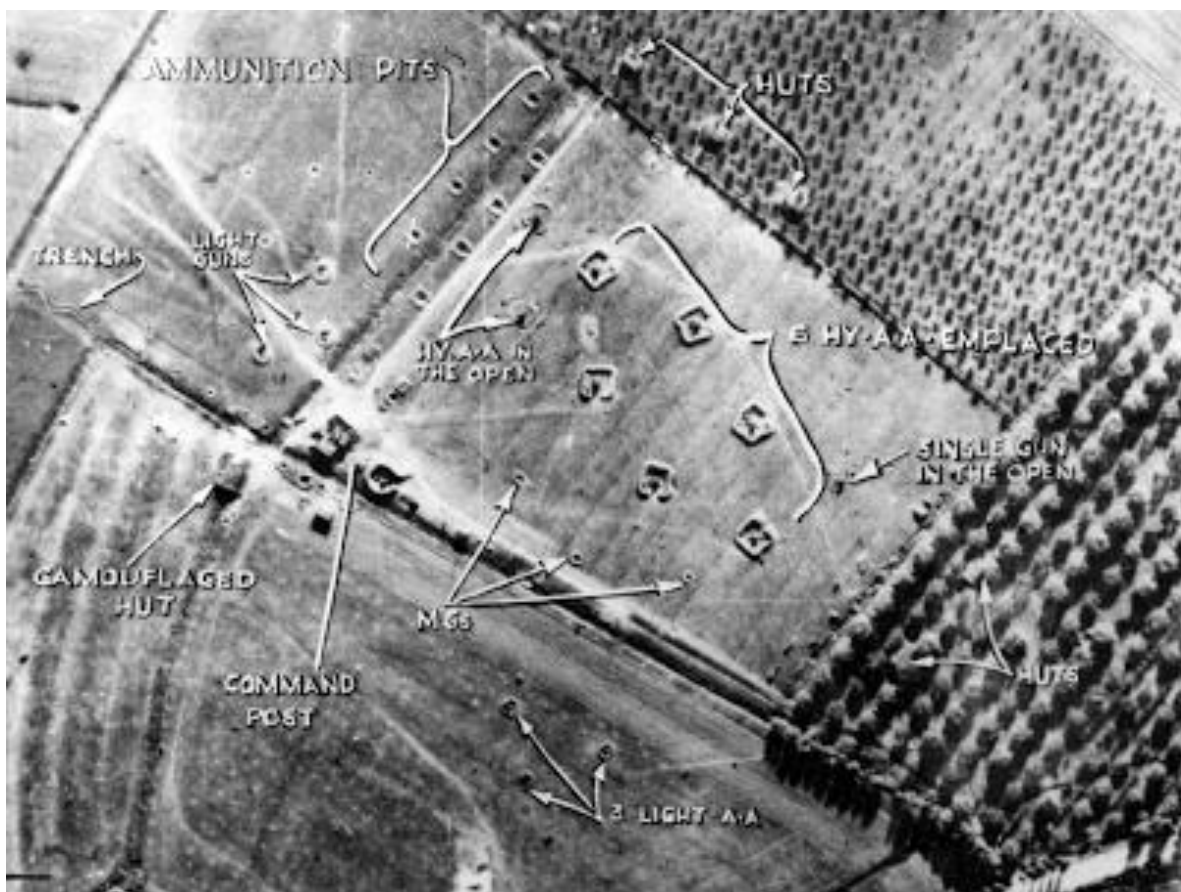
These developments would have been worrying enough under any circumstances, given the inherent vulnerability of airborne air transport – the massed formations of large, slow-moving aircraft and gliders flying straight and level at low altitude. But the build-up of German flak around Arnhem and Nijmegen gave cause for particular concern because it was suspected of being far from coincidental. Both the RAF air transport commander, Air Vice-Marshal Hollinghurst, and Browning feared that operational security had been breached,(91) and these concerns were shared by 1st Airborne Division's head of intelligence. On 14 September he wrote:

Perhaps as usual the Germans have misappreciated our intention and they really do think we wish to destroy the bridges which we photograph but do not bomb, or perhaps they perceive as we have that the bridges are a suitable airborne target. Even if they do not realise this the security for the operation has been so appalling that some breeze must have reached them.(92)

In fact, while the Germans were expecting an Allied ground offensive in Holland, as well as the possible use of airborne troops, they do not appear to have identified Arnhem as a potential *airborne* objective. However, Luftwaffe records do confirm that flak was being strengthened in the Market Garden area as a direct result of the decision to establish a defensive line between Antwerp and Maastricht. Both the formation and sustainability of this line depended on the integrity of the communication routes behind it. Presumably, because these were felt to be vulnerable to air interdiction, orders were issued to strengthen anti-aircraft defences at key points.

On 5 September, Luftgau Belgium-Northern France Field Headquarters received orders 'to put A.A. [anti-aircraft] artillery into the German western position to provide defence against air attack for troops fighting there, and also to cover defiles, bridges, etc. on supply routes.' The headquarters was specifically instructed to protect the area 'between Antwerp and Maastricht'.(93) The lines of communication serving the more westerly sector of this region ran directly through Arnhem and Nijmegen, and could have been severed if their vital bridges over the Neder Rhine and the Waal had been destroyed. This doubtless explains why they were singled out for the additional flak cover noted by Allied air reconnaissance.

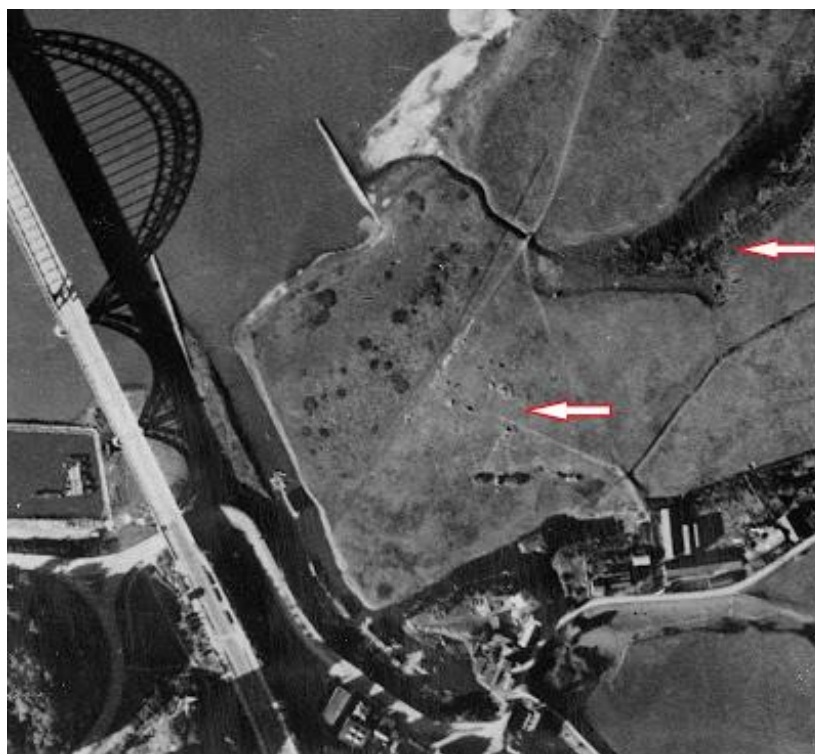
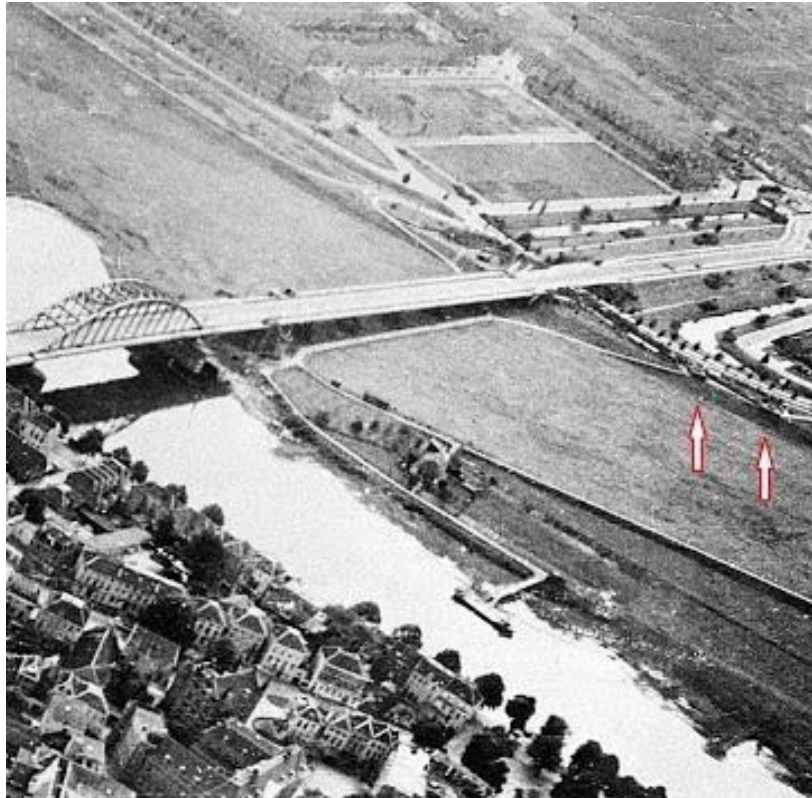
Many historians have since argued that the flak threat was much exaggerated by the RAF. However, 1st Airborne Division's post-operation report records that the flak estimates came not only from RAF but also Army photo-interpreters; they were in full agreement. Close inspection of the surviving imagery does suggest that high-level vertical shots might sometimes have failed to provide sufficient resolution to establish reliably whether flak emplacements were occupied or not, and distinguishing between real and dummy positions would have been particularly difficult. In such circumstances, there may have been some tendency for the interpreters to err on the side of caution, but the consequences of a significant underestimate could equally have been disastrous.



*Another heavy anti-aircraft battery located between
Nijmegen and Arnhem*



*Heavy anti-aircraft artillery battery south-east of Arnhem
showing occupation between 6 and 12 September*

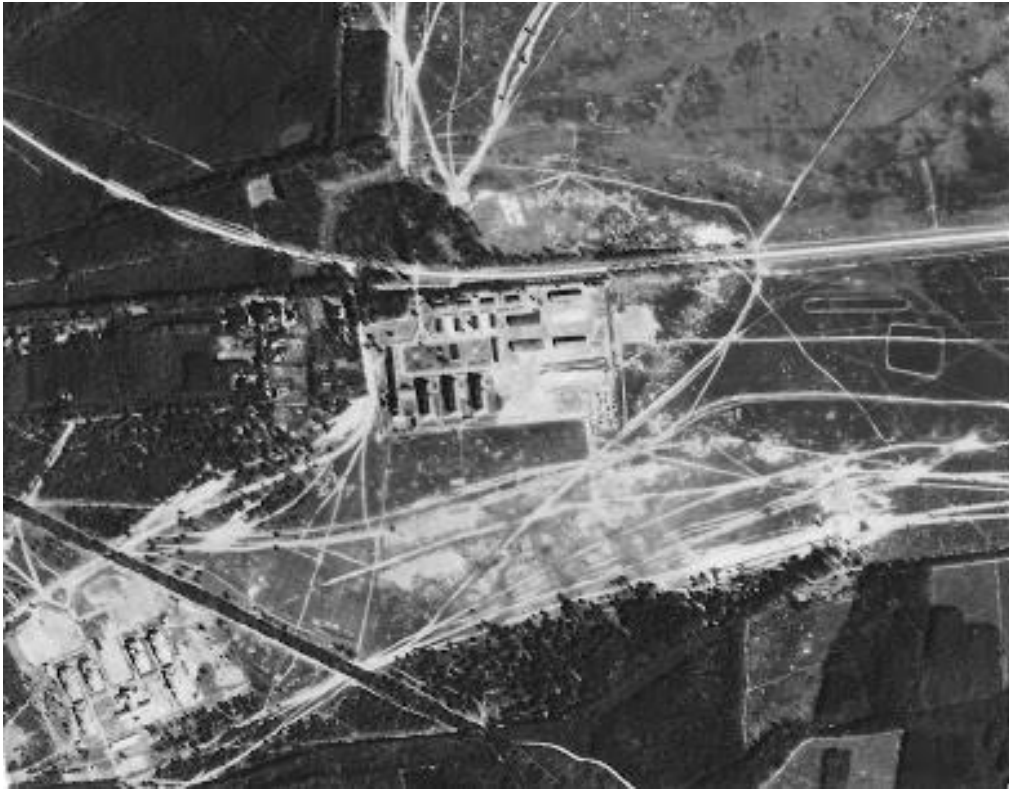


Flak positions near the Arnhem and Nijmegen road bridges

A large quantity of imagery gathered around Arnhem demonstrated that the Allies were targeting an area of considerable importance to the German military. There were photographs of barracks, ranges, communications facilities, rail and storage depots and, of course, Deelen airfield. Before the war, this region had been extensively used by the Dutch armed forces, particularly for training and exercises. After Holland's surrender in 1940, the Germans took over the military facilities in and around Arnhem, including the various barracks and training areas. An intelligence summary prepared by 1 Parachute Brigade before Market Garden noted that the training area northwest of Arnhem had primarily been used for armoured and motorised troops, including SS units and 'Hermann Goering reinforcements units'. The headquarters for armoured warfare training was at Zwolle, 42 miles north of Arnhem.

As for the barracks, Arnhem boasted five in total, with an estimated capacity of around 5,000 troops. There were also infantry and artillery barracks at Ede, close to the airborne landing areas, that could accommodate around 3,000 troops. At Deelen airfield, there were thought to be 2,000 Luftwaffe personnel in July 1944. After the Allied landings in Normandy, it seemed likely that the training activities associated with the Arnhem area would have been scaled down, but there was evidence to suggest that, while some troops had moved on, others had arrived in their place.(94)

There was an obvious logic behind such assessments. Boasting extensive military facilities, including barracks, Arnhem was effectively a military base and one of the few major crossing points over the river that formed the last natural barrier against an Allied advance into Germany. On these grounds, alone, a significant German presence was highly probable. Moreover, quite apart from the Dutch resistance reports on the arrival of German troops at the barracks, the Allies also captured orders to strengthen defences around the Rhine crossings, which were issued to German home defence and occupation troops.(95) Nevertheless, as we have seen, 21st Army Group and its subordinate formations were adamant that the Germans had left Arnhem largely undefended. The barracks were unoccupied and the ranges deserted; the main German military presence in Holland was concentrated near the front line, 64 miles to the south.(96) The Allies were thus surprised to discover that the Germans could mobilise numerically strong forces in the Arnhem and Nijmegen areas at very short notice in response to the airborne landings.

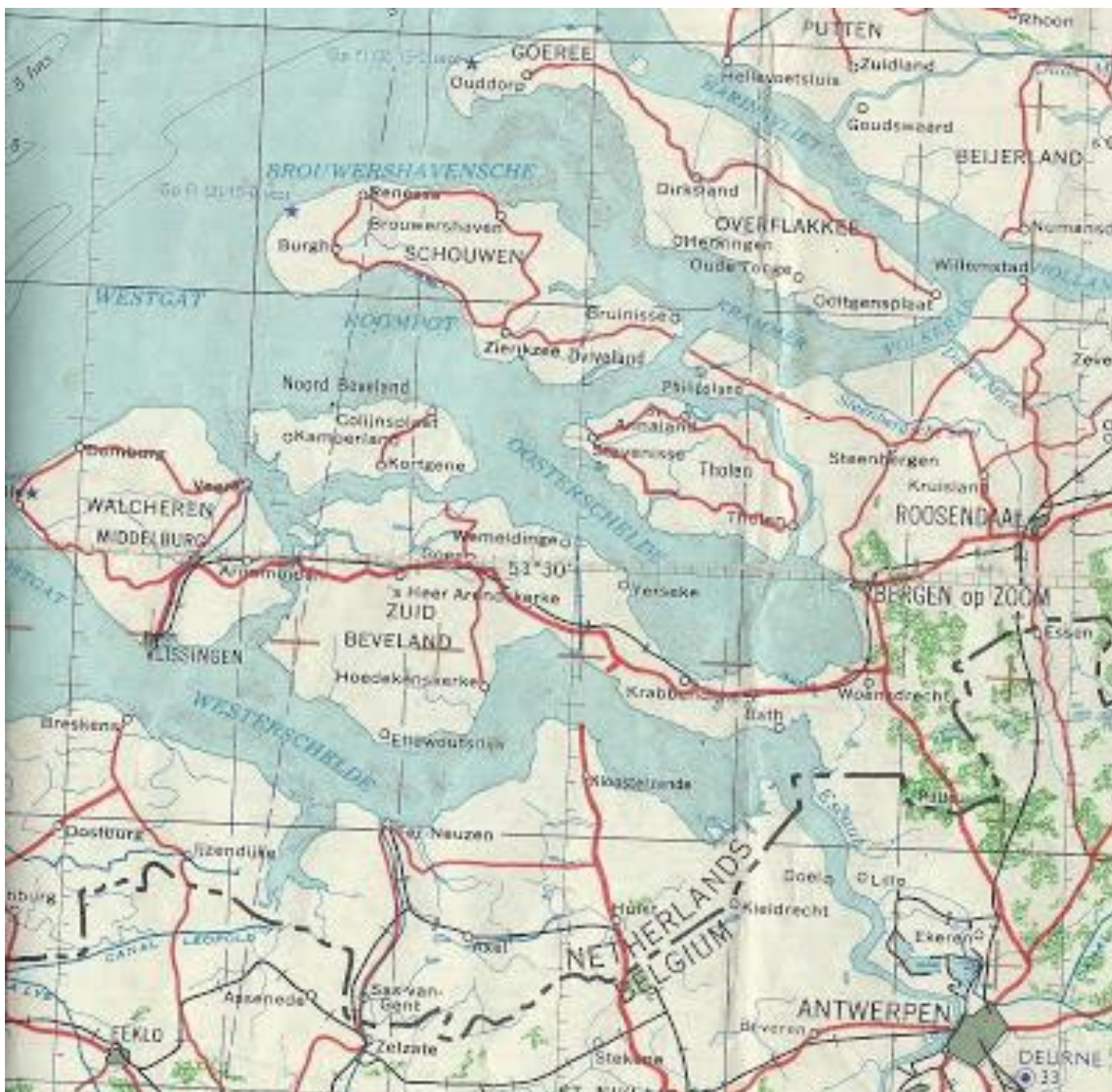


Two of the five German barracks in the Arnhem area



Deelen airfield, another major element within Arnhem's military infrastructure

Elsewhere in Holland, air imagery also captured the withdrawal of the German 15th Army across the Scheldt Estuary during the first two weeks of September – a manoeuvre that saved them from a second disaster on the scale of the Falaise Pocket and brought thousands of additional troops into the Market Garden area. As early as 5 September, barely one day after British forces entered Antwerp and blocked 15th Army's escape over land, air reconnaissance imagery revealed increased shipping activity on the north bank of the Scheldt at Vlissingen, involving landing craft and auxiliary vessels.



The area of 15th Army's escape



Montage of air imagery of 15th Army troops and vehicles being loaded at Terneuzen for the Scheldt crossing

On the south bank, at Terneuzen, air photographs revealed barges and ‘a concentration of 150/200 vehicles’, which was substantially located ‘on the roads adjoining the quays.’ Soon, the ‘German Dunkirk’ was in full swing.(97) On the 10th, air imagery provided ‘considerable evidence of the withdrawal of the German Forces from the area between Bruges and Antwerp’. The harbours at Terneuzen and Breskens were ‘plainly being used as the evacuation points to the islands of Walcheren and South Beverland’ and unloading was observed at Vlissingen and Hoedekenskerke.

The ferries that normally ply between these ports are loaded full with MT and are obviously being worked hard. In addition a number of TLC [Tank Landing Craft] type III are being used as ferries together with pontoons and small barges ... Several covers of Breskens during the day show a considerable amount of MT waiting to be ferried across. More vehicles are present during the morning than in the afternoon.(98)

Even after Breskens was bombed on the 11th, it was noted that the shuttle service across the estuary to Vlissingen was being maintained by at least four landing craft and a ferry, and four further landing craft and a barge were seen approaching Vlissingen from further east, 'probably from Terneuzen'.(99)



Shipping used for 15th Army's escape, Breskens, September 1944

Ultimately, over 16 days, the Germans succeeded in evacuating six divisions across the estuary – 100,000 troops, 6,000 vehicles, 6,000 horse-drawn wagons and 750 artillery pieces. At least three of these divisions would contribute to the German victory in Market Garden.(100) British intelligence officers certainly acknowledged that elements of 15th Army might be encountered during the offensive but this realisation exerted no tangible influence on Allied plans.



The bombing of Breskens, 11 September 1944

Conclusion

The Allies did not, of course, build their intelligence picture exclusively on air reconnaissance. Multiple sources were employed, just as they are today, including ULTRA, Dutch resistance reports, POW interrogations and captured documents, as well as air imagery. However, we can legitimately ask what assessment air imagery might have supported before Market Garden, objectively considered. Despite the resource constraints and unfavourable weather conditions, and the limited time available, air imagery backed the following conclusions:

[1] Heavily wooded and urban terrain and extensive polder-land had the potential to make Arnhem and Nijmegen very difficult areas in which to conduct offensive ground operations.

[2] The terrain features of the Arnhem area were also unfavourable for airborne and particularly glider-borne operations.

[3] Rapidly increasing anti-aircraft defences in the Market Garden area posed a significant threat to Allied troop carriers and glider combinations.

[4] Parts of the battle area were extensively militarised, suggesting the presence of enemy personnel in considerable numbers.

[5] Tens of thousands of German troops were withdrawing into Northern Holland across the Scheldt Estuary, potentially threatening an Allied advance north from the Dutch-Belgian frontier.

[6] A mechanised unit possessing at least some tanks and AFVs was positioned a few miles north of Arnhem on 12 September and would probably be encountered in the Market Garden area after the operation began.

On this basis, the imagery, combined with intelligence from other sources, provided grounds for two particular conclusions. First, Arnhem was not an especially favourable objective for the type of operation that the Allies had in mind; second, if the operation

targeted Arnhem, the airborne might well be confronted by at least some German armour, bolstered by a substantial range of other troops drawn from across the military spectrum. Some of the earlier reports offered precisely this analysis, but their discouraging tone ultimately made way for a more optimistic one. The pessimistic appraisal proved the more accurate but not because 1st Airborne Division was confronted by armour, which was always expected and which did not, in any case, appear in force until it arrived from outside the battle area on 19 September. Rather, it was accurate because it drew attention to the likelihood that the Germans would be able to mobilise considerable numbers of military personnel in the Arnhem-Nijmegen area, including elements of II SS Panzer Corps. What the intelligence could not predict, of course, was the speed of this mobilisation, which substantially exceeded Allied expectations and probably contributed more than any other factor to the German victory.

As for Brian Urquhart's famous account of how a low-level Spitfire sortie took photographs of tanks assumed to belong to II SS Panzer Corps, the reality was rather different. In all probability, the low-level mission that Urquhart recalled photographed the bridges and not the tanks. It may be that the Allies had some prior knowledge of enemy activity in the Deelerwoud. After all, Flight Lieutenant Fuge flew his aircraft directly to the correct location and took the key photograph at the beginning of his first run. Equally, as there would not have been time to brief the Mosquito crew on the outcome of the earlier Spitfire sortie before take-off, there must at least be a possibility that its tasking was guided by other intelligence.

Yet it is still extremely unlikely that this information would have been sufficiently specific to persuade the JPRC to sanction a low-level reconnaissance mission by a squadron that lacked the essential expertise and equipment. It was a high-altitude sortie that located armour north of Arnhem on 12 September 1944, including Panzer IIIs and IVs 'tucked in underneath woods'. However, they belonged not to II SS Panzer Corps, but to the Hermann Goering Parachute Panzer Training and Replacement Regiment, a formation that had long been using the same area for training, as the Allies well knew. It was probably reasonable to identify the tanks as a potential threat to 1st Airborne Division, but the issue was not straightforward. The appearance of modern tanks such as Panthers or Tigers in the imagery would certainly have provided

grounds for serious concern, but the prevalence of older model Panzer IIIs and IVs could well have suggested to an experienced intelligence officer that they belonged to a second-line unit of questionable combat capability. A reasonable conclusion might have been that the photograph reinforced the broader intelligence picture of German militarisation in the Market Garden area but did not necessarily point to a specific threat from a first-line panzer formation at Arnhem.

Research Methodology

Since *Arnhem: The Air Reconnaissance Story* was first published, there has been considerable interest in the research methodology employed. The basic research path followed during the preparation of this study is therefore detailed here. The primary objective was to examine the contention that the Allies obtained air photographs of German tanks in the Arnhem area shortly before Market Garden was launched. As we have noted, both Brian Urquhart and Tony Hibbert claimed to have seen imagery of Panzer IIIs and IVs parked in woods. Their story had already been partially considered during earlier research, which concluded that details of Brian Urquhart's account, as reproduced in multiple published histories, were probably incorrect.⁽¹⁰¹⁾ One possibility, at least, was that the sortie he remembered was flown at high rather than low altitude, and that the photographs were enlargements of high-level vertical shots rather than low-level obliques, but this line of enquiry was not pursued at the time.

The initial research task involved an extensive trawl through the relevant documents in the UK National Archives, searching particularly for interpretation reports confirming that tanks were spotted. This produced just one document of interest, already well-known to historians, which recorded the presence of a single AFV on the edge of the Deelerwoud on 13 September - thought to be part of a convoy.⁽¹⁰²⁾ However, it was clear that many tactical interpretation reports had been destroyed after the war. The only other primary source of some relevance was the Operation Record Book of 2 Squadron, RAF, which noted the possible presence of tanks and self-propelled west of Nijmegen on 16 September.⁽¹⁰³⁾

The most positive outcome from this early investigation concerned the wartime imagery interpretation process. This drew attention to the generation of the so-called

'Form White' for transmitting high-priority intelligence.(104) It seemed likely that, if tanks had been observed in or around Arnhem, a Form White would have been raised. Although the forms themselves have not survived, their creation is shown in the records of the ACIU. In the period before Market Garden, Spitfire sorties in the prospective battle zone resulted in the production of only a handful of Form Whites. It was for this reason, first and foremost, that mission 106G/2816 became a focus of attention. Apart from the fact that it was flown by the right squadron (541 Squadron – the RAF Benson Spitfire squadron responsible for Holland) on approximately the right date (12 September), and was confined to the airborne objectives, it also resulted in the generation of a single Form White relating to the Deelen area.(105)

ACIU.

SECRET
13.9.44.
FORM 540
APPENDIX 4011

INFORMATION SUMMARY NO.1173.

A resume of Information received up to 23.59 hrs. on 12.9.44.

(NOT TO BE COPIED IN WHOLE NOR IN PART. THE CONTENTS ARE STRICTLY
CONFINED TO THE SECTIONS ON THE DISTRIBUTION LIST).

SORTIES DESPATCHED: (Objectives, claimed by Pilot, or Form White (F.W.).

(i) P.R.U.

106G/2812	36" & 14"	KARLSRUHE-HEILBRONN Rlys., STUTTGART-
/2813*	36"	APFENWEILER Rlys., STRASBOURG-COLMAR Rlys.
/2814	36"	SALZBRUCKEN-KAISERLAUTERN-MANNHEIM Rlys.,
/2815	36"	DARMSTADT (D.A.), BINGEN-HOMBURG Rlys.,
/2816	36"	BOULOGNE.
/2817	36" & 14"	IJMUIDEN, AMSTERDAM, -/SCHIJNENWOUDE S.P.B.
/2818	36" & 6"	(F.W.), ROTTERDAM area, SAJEWOOOT area.
/2819	36"	ELGUE area.
/2820	36"	DEELEN A/F (F.W.), ARNHEM area, NIJMEGEN area.
/2821	36"	STRASBOURG-APFENWEILER-HELFORT Rlys., PARIS.
		FRANKFURT/REBSTECK A/F, WIESBADEN A/F (F.W.),
		BONN-KOBLENZ-BINGEN-FRANKFURT Rlys.
		TEXEL ISLAND & area, THRSCHELLING.
		AMSTEL, REHEN, SCHAGEN, A/Fs HILDESHHEIM,
		HOPSTEN, KNUFT, RHEINE, QUACKENBUCK.
		BUSUN, KIEL, -/CANAL (D.Ls), HOHN A/F,
		RENSBURG & U/B Yds., SCHIERSONVIECOG,

ACIU summary showing 106G/2816 and recording the Form White relating to Deelen

On this basis, imagery from 106G/2816 was requested from NCAP. However, it transpired that no photographs from this mission were held in the UK archives. A further request was therefore submitted for imagery from any other sorties that covered Deelen on 12 September. In response, NCAP provided the wartime plot of

imagery captured by the 544 Squadron Mosquito. A single frame drawn on to the plot (4023) was of immediate interest, as it had been marked with the letter 'A'.⁽¹⁰⁶⁾ This letter would also have appeared on the photograph itself (or more probably an enlargement of part of the photograph), and on an accompanying interpretation report. Unfortunately, frame 4023 was missing from the NCAP collection, and there was no sign of the interpretation report among the files at the National Archives.



*Enlarged overlay plot of 544 Squadron Mosquito imagery
of Deelen and the Deelerwoud, 12 September 1944*

At this stage, there seemed to be no obvious way forward. It was only possible to resume the study after the Dutch air reconnaissance archive was placed online. It then transpired that the imagery from 106G/2816 had survived and had been digitised in its entirety. An online search for a photograph began, focusing on exactly the same location as the Mosquito frame 4023. Two photographs from 106G/2816 – frames 4014 and 4015 – were found to have covered this area, and frame 4015 had been

marked with several letters. Naturally, therefore, it was assumed that they referred to objects of military significance described in an interpretation report, and this supposition was reinforced by the views of several members of the RAF intelligence community, both serving and retired. In fact, the lettering had been added after the war. Nevertheless, by an extraordinary coincidence, a high-resolution copy of frame 4015 revealed a large column of military vehicles, including armoured vehicles, either parked by or moving along the track through the Deelerwoud, and the larger rectangular objects believed to be supply dumps.

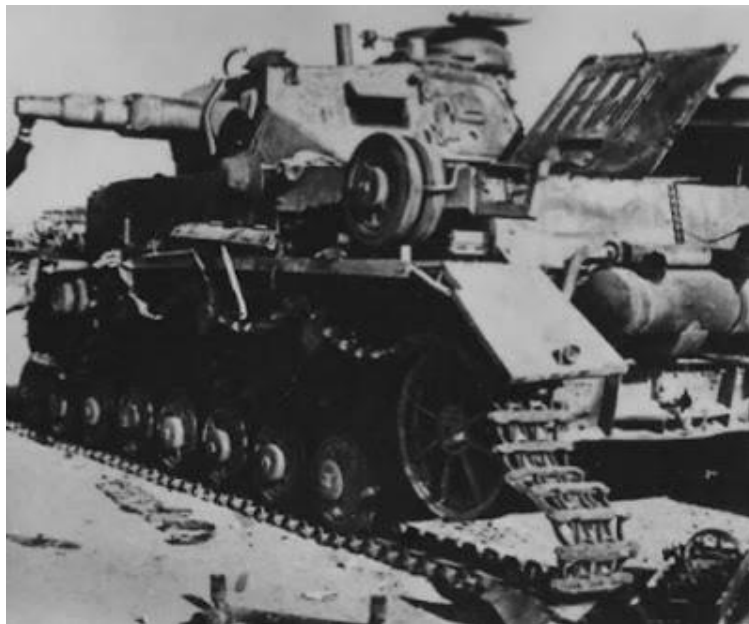
In seeking to identify the vehicles in the photograph, the key challenge could be summed up in one word – resolution. The technique used to enlarge air photographs in the Second World War has already been described, but it is worth revisiting. To produce the maximum clarity and detail, blow-ups were created directly from the negative of the frame rather than the print. To give some idea of the clarity that resulted from this approach, a wartime enlargement of three Panzer IIIs is reproduced here. Further illustration is provided by the two more detailed photographs of German heavy anti-aircraft artillery batteries reproduced earlier in this study (see pages 47 and 49).



Vertical image of early Panzer IIIs; key distinguishing features include the front hull and vertical frontal armour in parallel alignment and the forward position of the turret

In the absence of negatives for the wartime photographs, it is impossible to recover the resolution that would have been available to Allied interpreters in 1944. In short, we will never be able to view frame 4015 (or 4014) in the same detail that would have

been available to them because of the loss of resolution that occurs during the transition from negative to print, and then from print to electronic scan. Frame 4015 was taken in extremely sunny conditions, and there was a great deal of light reflection from the top of the vehicles (although there was also a lot of shadow and tree cover). Nevertheless, the resolution was so poor that it was initially hard to determine the orientation of the column. At first, due partly to the position of the most visible Panzer IV turret, it seemed as if the column might be moving north. The common German practice of rotating turrets during servicing and maintenance was not taken into consideration until accumulating evidence demonstrated unequivocally that the vehicles were heading in the opposite direction.

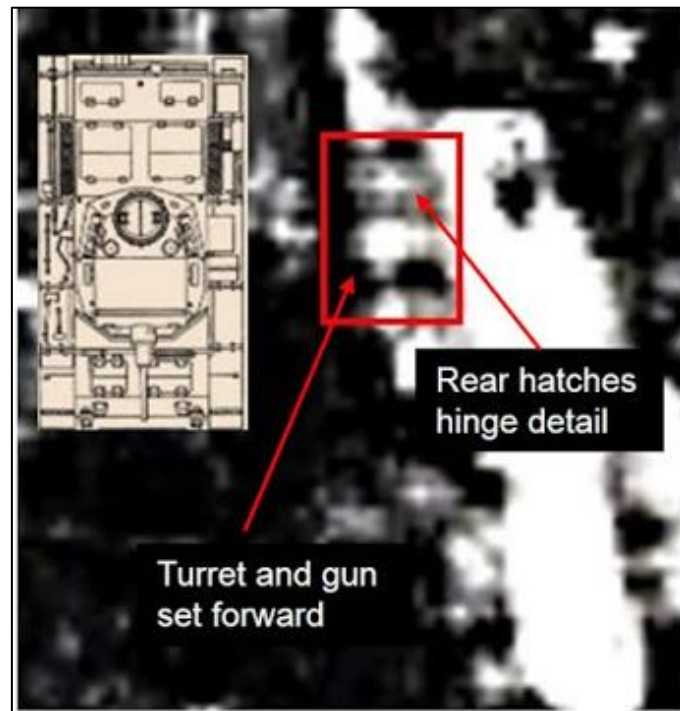


Panzer IV undergoing maintenance with turret rotated

Some useful assistance was provided by the Air Ministry's wartime guidance 'for Officers concerned with the Examination and Interpretation of Air Photographs', which noted that tanks could be differentiated from motor transport in a number of ways. First, 'By their appearance (presence of turret shadow, tank suspension or other feature) on large-scale photographs or by their dimensions. In comparison with its length, the width of a tank is considerable, the length-width ratio being less than 2.5 and usually about 2.0. Motor transport vehicles, with few exceptions, have ratios in excess of 2.5.' Second, 'The tracks made by tanks are very prominent and have

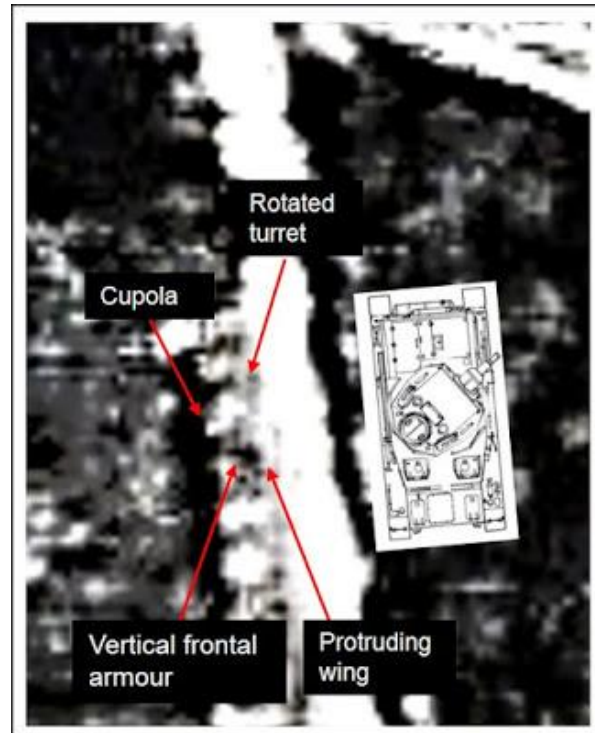
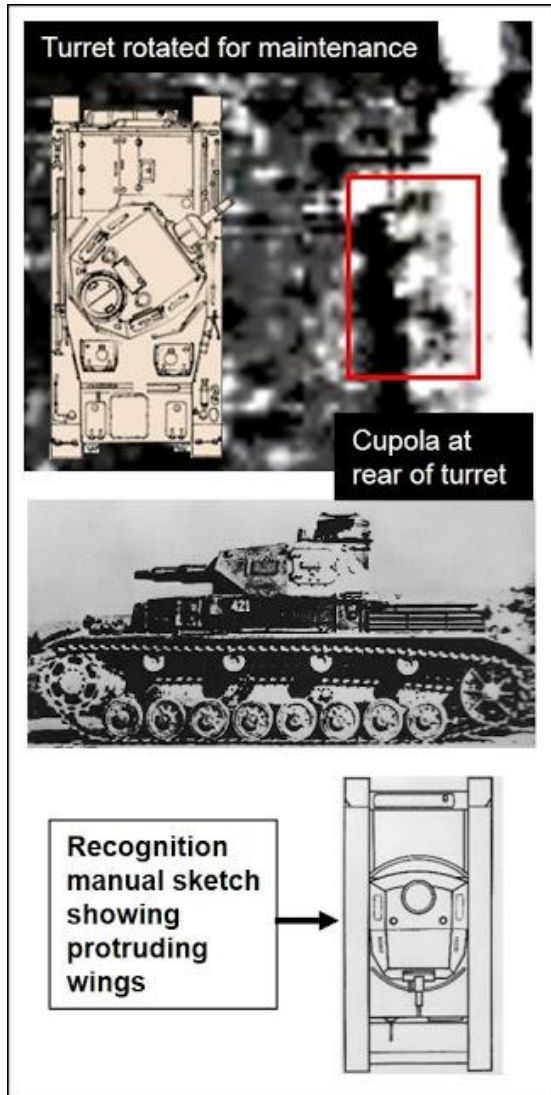
characteristic turning marks which are not smooth like motor transport turning circles.(107)

In addition, the War Office's Air Recognition Manual drew attention to certain specific features of the Panzer III and IV that appeared in vertical imagery. For the Panzer III, these included the 'turret set slightly forward'. For the Panzer IV, the attention of interpreters was drawn to the 'cupola at extreme rear and centre of the turret, which is set midway' and 'wings protruding beyond main body'.(108) Further relevant information from the Air Ministry guidance concerned the appearance of German supply dumps, which, it was said, 'normally consist of stacks, often about 20ft square, sited in woods or along tree-lined roads.'(109)



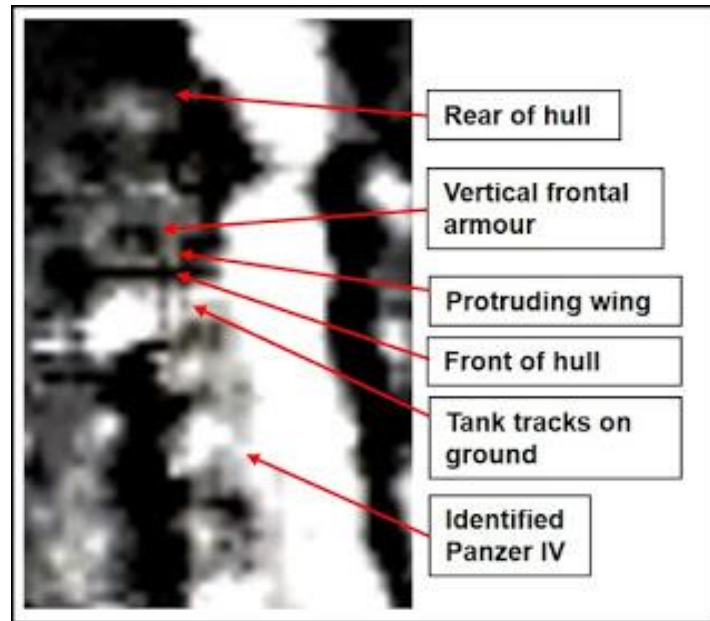
*Panzer III identification based on turret, gun
and rear hatch hinge detail*

The most obvious approach available to study the appearance of the tanks involved digital enlargement and enhancement of the imagery to the maximum extent, accepting some pixelation. The objects in the photograph could then be compared with further relevant imagery from the wartime period, drawing on the Air Ministry and War Office guidance.



Panzer IV identifying features

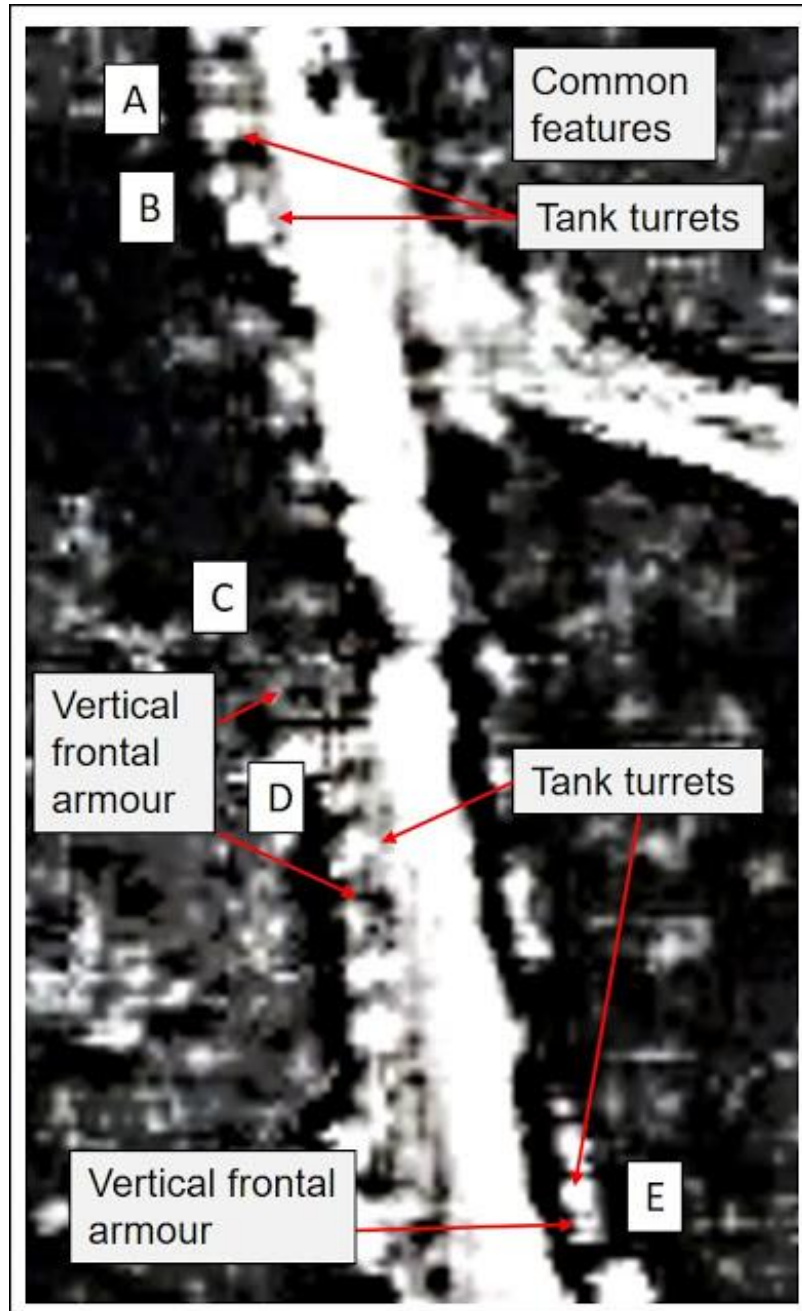
Via this means, it was possible to define the basic rectangular outline of tank hulls, such items as tank turrets and upright frontal armour – a particularly distinctive feature of the Panzer III and IV – and the Panzer IV ‘wings protruding beyond main body’. In addition, while light reflection obscured some smaller objects, it revealed others in extraordinary detail. The ‘certain’ identification of the Panzer III stemmed not only from the visibility of its turret and gun and the forward position of the turret (relative to the Panzer IV), but also from the symmetrical pattern of rear hatch hinges on top of the hull. The ‘probable’ Panzer IV parked under the trees left the markings of a tank track on the ground, perfectly aligned with the wing of the stationary vehicle. Beyond this, the length-width ratios of the three most visible tanks measured between 1.8 and 2.0 (exact measurement was impossible because of the amount of tree cover and shadow).



*Probable Panzer IV under trees; turret
is concealed by tree cover.*

No less revealing were the common features of the various objects in the photograph. Given the limited resolution available, a single speculative tank turret identification might reasonably have been called into question. However, at least four turrets are visible, and vertical frontal armour can be seen in at least three cases.

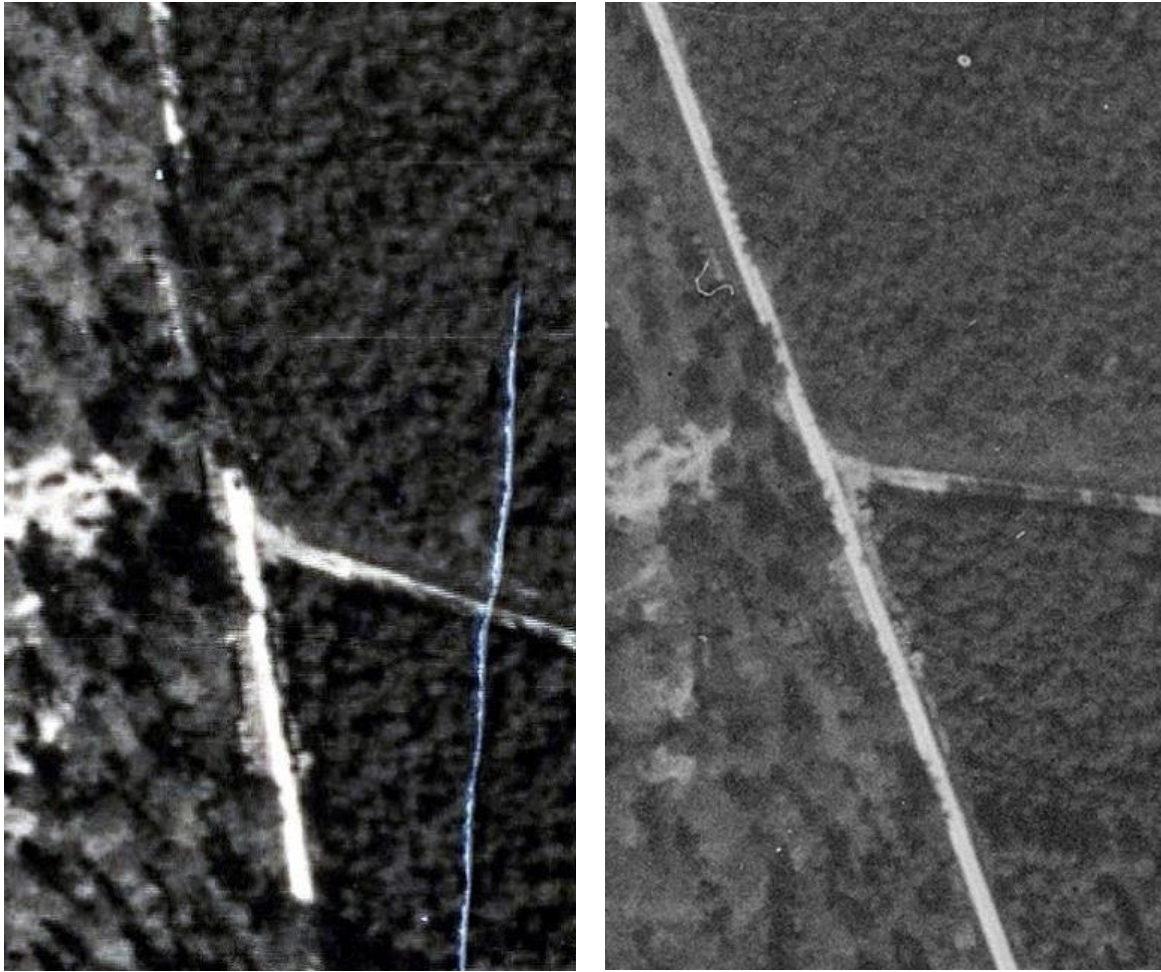
Relative to one another, these features were also positioned in accordance with the general layout of early model Panzer IIIs and IVs. The rear hatch hinges of the 'certain' Panzer III (labelled 'A') are located behind the turret. The front of the hull of the 'probable' Panzer IV under the trees (labelled 'C') is positioned in front of the vertical frontal armour. This tank, and the 'certain' Panzer IV (labelled 'D'), clearly display the correct relative positioning of the frontal armour and the protruding wing. The turret of the 'certain' Panzer IV is correctly positioned in the middle of the hull, well behind the frontal armour, just as the cupola is correctly positioned at the back of the turret. The 'probable' Panzer III on the other side of the track (E) displays first the hull front, then the upright armour, then the turret, replicating the layout of the three Panzer IIIs shown in the photograph earlier in this section. Additionally, the measurable distance from the vertical frontal armour to the rear of the hull was identical for tanks C and D, supporting the identification of tank C as a Panzer IV.



Another technique repeatedly recommended in the wartime literature is now known as *change detection*. A comparison of photographs taken at the same location on different dates will often reveal information that might not otherwise be apparent in a single image. It was not essential to employ change detection to analyse the 12 September imagery, as the German armoured column was relatively easy to spot. However, it seemed possible that this approach might assist in the identification of the German formation and provide clues regarding their subsequent activities.

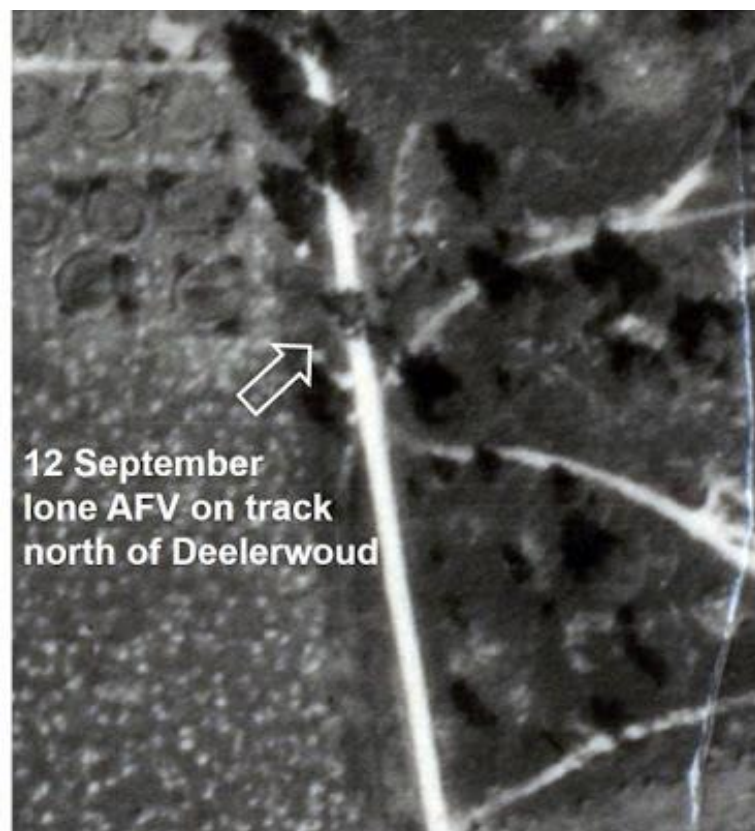
A further reason for using change detection was that there were obvious similarities between low-resolution images of our area of interest captured on 12 and 19 September – two days after Market Garden was launched. Indeed, apart from the presence of the supply dumps in the later photograph, it appeared that there might still be objects of some kind in the exact areas where the tanks were parked. Yet it was most unlikely that a German armoured column would have remained stationary in the Deelerwoud for such a significant length of time – especially after the Allied airborne assault began.

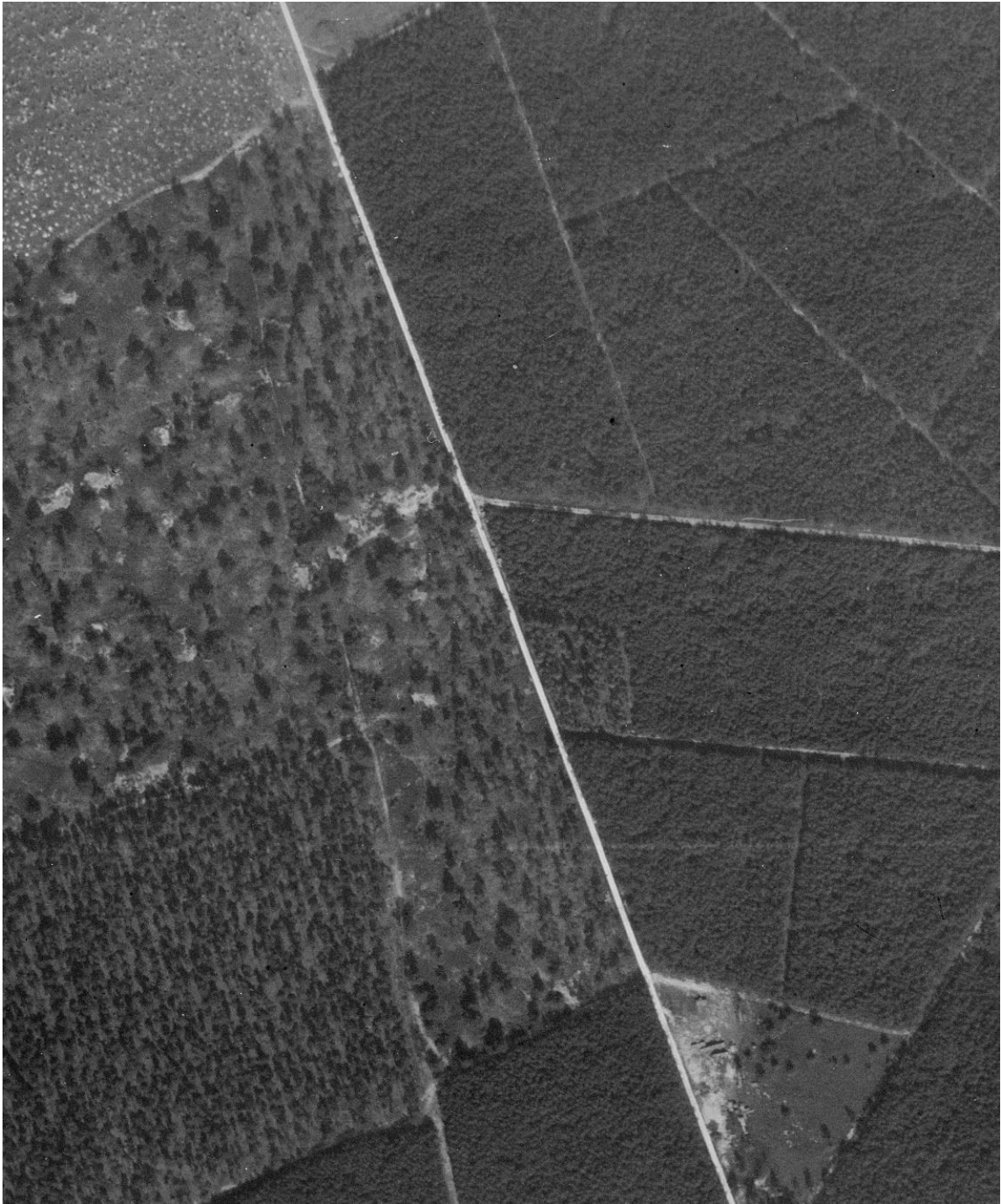
Close analysis of high-resolution photographs taken on both dates fortunately settled the issue. The objects visible along the woodland track on 12 September were three-dimensional in character. They clearly projected upwards towards the camera, and the effect was magnified by the extensive shadows that each vehicle generated. Numerous objects in the photograph were also obviously symmetrical. There were multiple straight lines, parallel lines and right-angles. By contrast, except where the supply dumps are concerned, these features were completely absent from the 19 September photos. The features visible on the 19th are two-dimensional and were caused by scarring left on the ground by parked (and often tracked) vehicles, which presumably stopped there regularly to rearm or refuel. No vehicle shadows are visible on the 19th, only tree shadows, and there are no symmetrical objects.



Left, the 12 September image clearly shows the armoured column; on the right, the 19 September image shows scarring from parked vehicles

The other important change was that the 12 September imagery showed several vehicles moving down the track through the Deelerwoud, whereas no vehicles were in evidence on the track on the 19th. Thus, the use of change detection reinforced the impression that the armoured formation photographed on 12 September only paused temporarily in the Deelerwoud and then deployed elsewhere.





On 19 September the track through the Deelerwoud was completely empty

Notes

1. Stephen Ambrose, *D-Day: June 6 1944, The Battle for the Normandy Beaches* (Pocket Books, London, 2002), p. 517.
2. FH Hinsley, EE Thomas, CAG Simkins and CFG Ransom, *British Intelligence in the Second World War: Its Influence on Strategy and Operations*, Vol. 3, Pt. 2, (Her Majesty's Stationary Office, London, 1988), pp. 382-386; William Buckingham, *Arnhem 1944* (Tempus, Stroud, 2004), pp.76-77, 95; Cornelius Ryan, *A Bridge Too Far* (Wordsworth Editions, Ware, 1999), pp. 85-87, 109-110; Richard Lamb, *Montgomery in Europe 1943-1945: Success or Failure?* (Buchan & Enright, London, 1983), pp. 215, 222, 225-6; Geoffrey Powell, *The Devil's Birthday* (Leo Cooper, London, 1984), pp. 40-48; Peter Harclerode, *Arnhem: A Tragedy of Errors* (Caxton Editions, London, 2000), pp. 30-45; Martin Middlebrook, *Arnhem 1944: The Airborne Battle, 17-26 September* (Penguin, London, 1995), pp. 64-67; Harold Deutch, 'Commanding Generals and the Uses of Intelligence,' in Michael Handel (ed.), *Leaders and Intelligence* (Frank Cass, London, 1989), pp. 245-246.
3. Sebastian Ritchie, *Arnhem – Myth and Reality: Airborne Warfare, Air Power and the Failure of Operation Market Garden* (Robert Hale, London, 2011), pp. 89-104, 112-115.
4. Robert Kershaw, *It Never Snow in September: The German View of Operation Market Garden and the Battle of Arnhem, September 1944* (Ian Allen, Hersham, 2004), pp. 16, 28, 38, 78.
5. *Airborne Operations: A German Appraisal*, Office of the Chief of Military History, Department of the Army (US Army Foreign Military Studies Series, 1950), pp. 54-55.
6. Kershaw, *It Never Snows in September*, pp. 108-112, 119-120.
7. Powell, *The Devil's Birthday*, pp. 43-44.
8. *Daily Telegraph* obituary, June 1995.

9. Nigel Hamilton, *Monty: The Battles of Field Marshal Bernard Montgomery* (Hodder & Stoughton, London, 1944), pp. 428-429; Chester Wilmot, *The Struggle for Europe* (Reprint Society, London, 1954), pp. 528-529.
10. UK National Archives (TNA) WO 219/605, Annex 1a to Field Order 3 for Operation Linnet, G2 estimate of enemy situation, 30 August 1944.
11. TNA WO 285/3, Second Army Intelligence Summary, 1 September 1944.
12. TNA WO 285/3, Second Army Intelligence Summary, 2 September 1944.
13. Kershaw, *It Never Snows in September*, pp. 11-13.
14. TNA WO 285/3, Second Army Intelligence Summary, 3 September 1944.
15. Kershaw, *It Never Snows in September*, p. 38.
16. TNA DEFE 3/221, XL 9188, 5 September 1944.
17. TNA DEFE 3/221, XL 9245, 6 September 1944.
18. TNA WO 285/3, Second Army Intelligence Summary, 6 September 1944; WO 171/341, XXX Corps intelligence summary, 7 September 1944; WO 171/393, 1st Airborne Division Planning Intelligence Summary, 7 September 1944.
19. TNA WO 285/3, Second Army Intelligence Summary, 9 September 1944.
20. TNA WO 171/393, 1st Airborne Division Planning Intelligence Summary, 6 September 1944.
21. TNA WO 171/393, 1st Airborne Division Planning Intelligence Summary, 7 September 1944.

22. TNA WO 171/393, 1st Airborne Division Intelligence Summary, 8 September 1944.
23. Karel Margry (ed.), *Operation Market Garden Then and Now*, Vol. 1 (Battle of Britain International, London, 2002), p. 82.
24. TNA WO 285/9, Dempsey diary, 9 and 10 September 1944.
25. Margry, *Operation Market Garden Then and Now*, Vol. 1, p. 82.
26. TNA WO 219/1924, SHAEF intelligence summary, 16 September 1944. A number of histories have assumed that this intelligence arrived at about the time this summary was issued. However, the SHAEF document was prepared weekly and covered intelligence received over a seven-day period. The potential role of the depot at Cleve is explicitly referred to in an annex to the Market operation order, issued by Headquarters First Allied Airborne Army on the 13th, presumably on the basis of another update from 21st Army Group or Second Army sometime earlier. See TNA AIR 37/1217, Headquarters Troop Carrier Forces, US Army Air Forces, Field Order No. 4 for Operation Market, 13 September 1944.
27. Major General RE Urquhart, *Arnhem* (Pan, London, 1958), pp. 19-21.
28. TNA WO 171/132, 21st Army Group Intelligence Summary, 12 September 1944.
29. TNA AIR 37/1217, Information from Northern Group of Armies, Second Army and XXX Corps, as at 1100 hrs, by Lieutenant Colonel A Tasker, G-2, First Allied Airborne Army, 12 September 1944.
30. TNA WO 219/5137, 1 Parachute Brigade Intelligence Summary, 13 September 1944.
31. TNA AIR 37/1217, Operation Market, 1st Airborne Division Planning Intelligence Summary, 14 September 1944.

32. TNA CAB 106/1133, Netherlands Military Attaché to Lieutenant Colonel GW Harris, Cabinet Office Historical Section, 30 March 1953.
33. CB Macdonald, *The Siegfried Line Campaign* (Office of the Chief of Military History, Washington, 1965), p. 122.
34. DKR Crosswell, *Beetle: The Life of General Walter Bedell Smith* (University Press of Kentucky, 2010), p. 717.
35. TNA WO 171/132, 21st Army Group Intelligence Review, 18 September 1944.
36. Lamb, *Montgomery in Europe*, p. 225. Williams told Lamb that 2 SS Panzer Corps 'had refitted, so they were stronger than I expected'.
37. Field Marshal the Viscount Montgomery of Alamein, *Memoirs* (Collins, London, 1958), p. 297.
38. Kershaw, *It Never Snows in September*, pp. 38-43; Buckingham, *Arnhem*, pp. 52, 101-102.
39. Kershaw, *It Never Snows in September*, p. 41.
40. Ritchie, *Arnhem – Myth and Reality*, pp. 217-219.
41. Air Historical Branch (AHB), *The Liberation of Northwest Europe, Vol IV, The Breakout and the Advance to the Lower Rhine, 12 June to 30 September 1944* (unpublished official narrative, AHB copy), p. 147.
42. AHB, *Photographic Reconnaissance* (unpublished official narrative, AHB copy), Vol. 2, p. 51.
43. 'Thirty-Four Wing: An Unofficial Account' (unpublished wing history, AHB copy), pp. 44; Jimmy Taylor, '16 Squadron's Participation in Operation Market Garden,

September 1944, Pt. 2', *16 Squadron 1939-1945 Newsbrief Extra*, May 2001, pp. 42-44 (AHB copy). The detachment was commanded by Wing Commander CFH 'Sandy' Webb, DFC, who personally captured the well-known landing zone and Arnhem bridge imagery. There has been some confusion over the date on which the detachment returned to the UK. This has probably arisen because it initially flew back in preparation for Operation Comet, on 7 September. When Comet was cancelled, it apparently returned to France for a week, before again flying to RAF Northolt to operate in support of the airborne forces for the duration of Market Garden.

44. TNA AIR 27/2013, 541 Squadron F.540, September 1944.

45. TNA AIR 27/2013, 541 Squadron F.540, 6 September 1944. The three mission numbers were 106G/2676 (Arnhem), 2677 (Nijmegen) and 2678 (Grave).

46. TNA AIR 34/136, Interpretation Report BS 945, 19 September 1944.

47. 106 Group objectives in this period are recorded in TNA AIR 29/355, AIR 29/356, AIR 29/357, AIR 29/358, 106 Group daily information summaries, 6-16 September 1944.

48. TNA CAB 106/1133, Major General RE Urquhart to Harris, 22 November 1952.

49. Christopher Hibbert, *The Battle of Arnhem* (Batsford, London, 1962), p. 38; Ryan, *A Bridge Too Far*, pp. 85-87, 109-110.

50. Brian Urquhart, *A Life in Peace and War* (Harper & Row, New York, 1987), pp. 71-72.

51. *Ibid.*, pp. 72-73.

52. Ryan, *A Bridge Too Far*, p. 109.

53. Urquhart, *A Life in Peace and War*, p. 73.

54. Middlebrook, *Arnhem*, p. 65.
55. Urquhart, *A Life in Peace and War*, p. 73.
56. Ibid; Ryan, *A Bridge Too Far*, p. 108.
57. TNA CAB 106/1133, Lathbury to Harris, 5 April 1954.
58. TNA WO 171/393, 1st Airborne Division Planning Intelligence Summary, 7 September 1944.
59. 'Photographic Reconnaissance and Photographic Intelligence, 1939-1944', *Evidence in Camera*, Annex to Vol. VIII, 7 August 1944 to 5 March 1945, pp. 12-15 (AHB copy).
60. TNA AIR 27/2013, 541 Squadron F.540, August 1944.
61. 35 Reconnaissance Wing, Second TAF, *Air Recce* (unpublished and undated official report, AHB copy), pp. 17-18.
62. AHB, *Air Ministry Intelligence* (unpublished official narrative, AHB copy), Pt. 2, Chapter 5, para 11-14.
63. This statement is based on a survey of TNA AIR 29/355, AIR 29/356, AIR 29/357, AIR 29/358, 106 Group daily information summaries, 6-16 September 1944. Sometimes, 20-inch lens cameras were also used to capture high-altitude vertical imagery during the V-2 hunt.
64. http://www.pegasusarchive.org/arnhem/tony_hibbert.htm (accessed on 2 July 2015).
65. <http://www.wageningenur.nl/en/article/About-the-RAF-aerial-photographs-1943-1947.htm> (accessed on 2 July 2015).

66. TNA AIR 27/2013, 541 Squadron F.540, September 1944.
67. https://originals.dotkadata.com/?language=en#!1&bron=BWUR_WOII_RAF_USA_AF&sortienummer=106G%2F2816 (accessed on 2 July 2015).
68. https://originals.dotkadata.com/?language=en#!1&bron=BWUR_WOII_RAF_USA_AF&sortienummer=106G%2F2816&offset=468&id=224532 (accessed on 2 July 2015).
69. Kershaw, *It Never Snows in September*, pp. 134, 178-183.
70. <http://www.defendingarnhem.com/Worrowski.html> (accessed on 2 July 2015); <http://www.maparchive.ru/division/part15/Fallschirm-Panzer-Division%20Hermann%20Goering.pdf> (accessed on 2 July 2, 2015); TNA WO 219/5137, 1 Parachute Brigade Intelligence Summary, 13 September 1944.
71. Oberst Fritz Fullriede diary, Cornelius Ryan collection, Ohio University, entries of 8, 10, 11 and 13 September 1944. Fullriede was commanding officer of the Hermann Goering Parachute Panzer Training and Replacement Regiment.
72. Margry, *Operation Market Garden Then and Now*, Vol. 1, p. 117.
73. TNA AIR 27/20, 2 Squadron F.540, mission 35/16/31, 16 September 1944.
74. AHB, *Air Ministry Intelligence*, Pt. 2, Chapter 5, paras 19-22.
75. TNA AIR 29/356, Information Summary 1173, 13 September 1944, a resumé of information received up to 2359 hrs on 12 September 1944.
76. Fuge was posted missing during a mission over Berlin on 19 March 1945, and no trace of his aircraft was ever found. He is commemorated on the Runnymede Memorial, Panel 265.

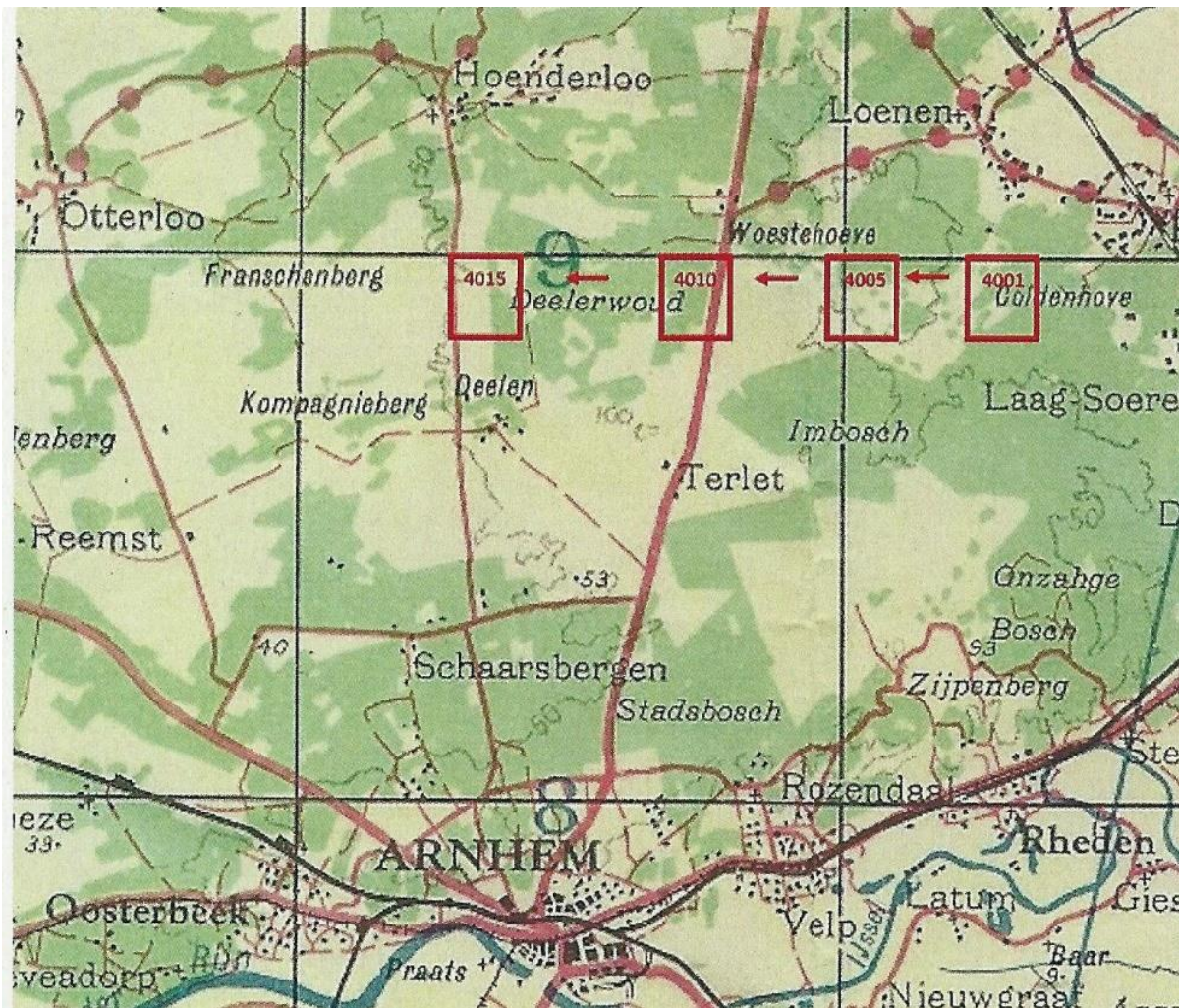
77. TNA AIR 27/2028, 544 Squadron F.540, September 1944.
78. National Collection of Aerial Photography, Overlay 24891, covering mission 106G/2830, 12 September 1944.
79. Kershaw, *It Never Snows in September*, pp. 134, 178-183.
80. AD Harvey, *Arnhem* (Cassell, London, 2001), p. 35.
81. Kershaw, *It Never Snows in September*, pp. 128-131, 304-306.
82. Stephen Badsey, *Operation 'Market Garden'* (Osprey, London, 1993), p. 41; Margry, *Operation Market Garden Then and Now*, Vol. 1, pp. 110, 117, Vol. 2, p. 499; Fullriede Diary, entries of 17, 19 and 20 September.
83. General Sir John Hackett, 'Operation Market Garden,' in MRD Foot (ed), *Holland at War Against Hitler: Anglo-Dutch relations, 1940-1945* (Frank Cass, London, 1990), p. 164.
84. TNA WO 171/393, 1st Airborne Division Planning Intelligence Summary, 7 September 1944.
85. AHB, *The Liberation of North West Europe Vol. 4, The Breakout and the Advance to the Lower Rhine, 12 June to 30 September 1944* (unpublished official narrative, AHB copy), p. 169, note 1.
86. Hollinghurst papers, Royal Air Force Museum, AC 73/23/49, comments on AHB monograph on the history of the airborne forces, p. 2.
87. Ibid., p. 3.
88. TNA WO 171/393, 1st Airborne Division Planning Intelligence Summary, 6 September 1944.

89. WO 171/341, XXX Corps intelligence summary, 7 September 1944.
90. The assertion that the flak guns were removed appears in Harclerode, Arnhem, pp. 64-65, and is based on imagery gathered by a 541 Squadron Spitfire on 6 September; for the correction see TNA WO 219/4997, HQ First Allied Airborne Army, Flak Estimate, Operation Market, prepared by Major TJ Lowe, 12 September 1944.
91. Hollinghurst papers, AC 73/23/49, comments on AHB monograph on the history of the airborne forces, p. 2.
92. TNA AIR 37/1217, Operation Market, 1st Airborne Division Planning Intelligence Summary, 14 September 1944.
93. War Diary of Luftflotte 3, September 1944, entry of 5 September 1944 (AHB copy).
94. TNA WO 219/5137, 1 Parachute Brigade Intelligence Summary, 13 September 1944.
95. TNA WO 171/376, Appendix A, Captured Order for Defence of the Rhine Crossings, 15 September 1944.
96. TNA AIR 37/1217, Operation Market, 1st Airborne Division Planning Intelligence Summary, 14 September 1944.
97. TNA AIR 29/355, Interpretation Report 6841, 6 September 1944, photographs taken on 5 September 1944.
98. TNA AIR 29/356, Interpretation Report 6865, 12 September 1944, photographs taken on 10 September 1944.
99. TNA AIR 29/356, Interpretation Report 6869, 12 September 1944, photographs taken on 11 September 1944.

100. Margry, *Operation Market Garden Then and Now*, Vol. 1, pp. 72-73.
101. Ritchie, *Arnhem - Myth and Reality*, pp. 132-134.
102. Margry, *Operation Market-Garden Then and Now*, p. 81.
103. TNA AIR 27/20, 2 Squadron F.540, mission 35/16/31, 16 September 1944.
104. AHB, *Air Ministry Intelligence*, Pt 2, Chapter 5, paras 19-22.
105. TNA AIR 29/356, Information Summary 1173, 13 September 1944, a resumé of information received up to 2359 hrs on 12 September 1944.
106. National Collection of Aerial Photography, Overlay 24891, covering mission 106G/2830, 12 September 1944.
107. *Illustrated Handbook for RAF Intelligence Officers concerned with Examination of Air Photographs*, Air Ministry Manual SD 439, July 1943, Part 4, p. 7, Section E.
108. *Recognition of Military Equipment from Air Photograph (Short Title - Air Recognition Manual)*, War Office, undated (AHB copy), PZ KW III, PZ KW IV.
109. *Illustrated Handbook for RAF Intelligence Officers concerned with Examination of Air Photographs*, Part 4, p. 6, Section C.



Map 1: the area covered by 106G/2816, 12 September 1944



Map 2: approximate location of first fifteen frames of 106G/2816, 12 September 1944